

COMPUTER TECHNOLOGY IN TEACHER EDUCATION: TOOL FOR
COMMUNICATION, MEDIUM FOR INQUIRY, OBJECT OF CRITIQUE

by

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Abstract

The central question in this thesis is: In what ways, if any, can communications technology be used to extend and integrate the learning and intellectual engagement of teacher education students? Underpinning this question is an assumption that there is a need to take action by way of investigating technology practices in teacher education programs that are educationally defensible. More particularly in the context of teacher education there is a need to examine ways in which the technology can be used as a medium for integrating disparate parts of teacher education and for broadening channels of professional communication amongst those with an interest in teacher education.

In order to respond to the question a number of technology practices have been established in one elementary teacher education program. In this thesis three projects, representative of these practices, are presented. The three projects set in an Education Studies course, a Language Arts Education course and a Mathematics Education course respectively, used either web-based or multimedia technology as a medium through which students could communicate, investigate and generate ideas related to the course goals. The analysis of the projects was concerned with both the means by which students engaged in the technology related tasks and the ways in which they represented their understandings. The data drawn on to conduct this analysis included the electronic texts produced by students, the comments and feedback on each project provided by students and instructors and my own observational notes. The key argument made in the thesis is that the technology served as 1. a medium for inquiry and 2. an object of study. In this respect student teachers were able to extend their engagement by making connections between people, resources and experiences in ways not normally possible and by learning about educational technology in ways that were practical, creative and critical. The conditions underpinning these extensions to student teachers' learning were collaborative writing, public audience, access to electronic resources and a research infrastructure.

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CHAPTER ONE

INTRODUCTION

It would be an unforgivable dereliction of the responsibilities of intellectuals if the potential offered by current developments [in computer technology] were not fully explored, and a concerted attempt made to shape their direction to bring about at least some of the much talked about utopian visions of communication in the electronic age. (Kress, 1998, pp.78-79)

These remarks by Gunther Kress set out an imperative for research concerning educational uses of information and communication technology (ICT). The argument underpinning this imperative is that in the current period of rapid change associated with new forms of communication technology, there is a need within academic and educational circles to go beyond the critique of those practices mediated by the technology. Rather, Kress proposes a theory of 'design'. Design in this sense involves shaping and remaking the resources available for communication. This extends to the design of curricular practices that might use those communicative and technological resources for educational purposes. The call for action that Kress makes has provided both justification and motivation for the research discussed in this dissertation. For the past three years I have attempted to explore and shape the direction of technology use in one education setting, namely a pre-service teacher education program. The imperative to do 'something' with technology has particular force in teacher education. Those working in universities and schools are increasingly expected to integrate technology into their teaching and learning practices. Teacher educators and student teachers are at the intersection of these two sets of expectations. In one sense, and as the statement by Kress implies, the question is no longer should we use technology as part of educational practice, rather how can we use it in ways that are purposeful and worthwhile? The research reported in this dissertation is, therefore, a process of curriculum design that has sought to establish a set of technology practices in a teacher education program that were educationally defensible and intellectually challenging.

The key question underpinning the research is: In what ways, if any, can communications technology be used to extend and integrate the intellectual work and learning of those studying to be teachers? This question was developed in light of the points raised in the previous paragraph. It was also developed in response to problems of fragmentation common to teacher education programs, as well as to the factors and conditions specific to the research site. Problems pertaining to program fragmentation and a lack of communication between those engaged in various parts of teacher education programs are frequently referred to in the literature, as I will discuss below. Thus, one intent of the research was to explore ways in which the technology could be used to provide a communication link between program parts. More particularly, this included an examination of the ways in which the technology provided a medium for connecting and integrating some of the seemingly disparate theories, resources and practices that are part of any teacher education program. Making these connections and drawing on them to justify one's own professional practice and beliefs is a central part of the intellectual work associated with learning to teach.

Second, the research was located in one cohort-based teacher education program in the Faculty of Education at the University of British Columbia. This one-year elementary teacher education program, known as CITE, a Community of Inquiry for Teacher Education, was established three years ago with the intent of creating a set of communicative and curricula structures that not only addressed the problems of program fragmentation, but also enabled those involved in the program to collectively investigate the array of practices associated with being a teacher in an elementary school. Learning to teach in this context was constituted as intellectual work. Thus the technology was used to augment the goals of this program, particularly by extending the range of social activities associated with the professional learning of student teachers.

The research was based on the hypothesis that educational technology could be used in ways that would extend learning and intellectual engagement in a teacher education setting. Underpinning this hypothesis are three related assumptions about learning, technology and teacher education. The first is that the technology can be drawn on to provide a set of conditions useful for learning when conceived as a medium for

communication, inquiry (Bruce & Levin, 1997) and design (Kress, 1998). The second is that these conditions are inherently social. Thus their use in an educational context such as teacher education has implications for the ways in which relationships between and among students and teachers are constituted, as well as for how professional knowledge is developed and learned. The third assumption is that learning to teach and learning to become part of a professional teaching practice is an intellectual and social process. Professional knowledge is generated in practice and through interaction with other people and their ideas. Some degree of critical and reflective skill is required to integrate ideas, develop theories of practice and justify one's practice to others.

The aim of this research has been to develop activities that use technology as a medium for communication, inquiry and design, and test their value in a teacher education setting and in relation to student teachers' learning and engagement. I argue in Chapter Two that the literature concerned with technology and teacher education under specifies the nature of the pedagogical conditions associated with technology use and their relationship to the content of learning. Thus this research is one effort to add to this body of literature. It is of note that the research was initially oriented toward considering the ways in which technology could be used as a tool for professional communication for teachers. During the course of the research this focus broadened to consider points of overlap between the ways in which student teachers used technology as part of their own professional learning and the ways in which technology could be used by teachers as part of the learning practices in classrooms.

The research is a case study of the use of technology in one teacher education program. An important presupposition underpinning the adoption of a case study approach is that any technology cannot be understood outside of its context of use. Thus, part of the aim of this research has been to elucidate the relationship between the background and motivations of particular individuals, the available resources, existing pedagogical practices, relevant social and institutional politics and technology use. Understanding the context has been a crucial part of the design of the technology activities. Moreover, as Bruce and Rubin (1993) suggest, understanding the relationship between the setting and technology use is an important precursor to evaluating the 'effects' of the technology.

Therefore documenting the factors that enabled and constrained the use of technology in the CITE program and the associated teaching and learning practices is a central part of the study and underpins the findings.

The research is also 'action-based'. My role as a researcher in the CITE teacher education program included the design of teaching and learning practices that had a 'technology' component. Over a period of three years, there were various iterations of 'technology' projects, with each project seeking to establish and refine the conditions that could extend the levels of learning and intellectual engagement. In this thesis I report primarily on three projects that took place in the third year of the CITE program and the third year of the technology research. In the first project students engaged in an online discussion concerned with matters pertaining to equity and technology in school settings. In the second project students contributed to a public forum attached to the journal *Reading Online*. In this forum issues pertaining to literacy, especially technology and literacy, were debated. In the third project students designed a mathematics presentation for school students using the multimedia program Hyperstudio. These three projects were chosen because they represented a diverse range of technology uses within the teacher education program. In this respect the three projects provided a point for comparison, as well as an opportunity to consider their collective effects and implications. What links the three projects is their intent to assist student teachers to make connections between people, ideas, experiences and resources relevant to the course in which they were located, as well as to other courses and program parts. In addition, each project provided students with an opportunity to learn with technology and about technology and its use in schools.

The evaluation of each project has been based on an analysis of the content of the electronic texts produced by students as well as the processes associated with the production of these texts. Methods of discourse analysis have been drawn on to describe the nature of the connections that students made between peers, instructors, other professionals, resources and experiences, and to document the substance of the connections. In particular, this included documenting the ways in which students connected and integrated the often disparate parts of teacher education programs - theory

and practice, research and personal experience, campus and practicum. The evaluative feedback provided by students and instructors in surveys, focus group discussions and interviews has been drawn on to augment the analysis of texts. On the basis of the analysis I was able to make some judgements about whether and how these activities enabled students to make connections in ways that extended their learning and intellectual engagement.

The major argument that I make in the dissertation is that the use of technology in the CITE program enabled student teachers to extend their learning and levels of intellectual engagement in two key ways. First, in each project the technology provided a distinctive media through which student teachers could make connections between and among their peers, instructors and others in the professional field. Likewise in each project the technology provided a distinctive media through which student teachers could make connections between ideas, resources and experiences and in ways that bridged aspects of their coursework. In some cases, although certainly not all, this enabled students to productively integrate theory and practice, campus and practicum, research and experience. Second, within each of the projects technology became an object of learning. Part of the focus of the projects and crucial to the research was an opportunity to learn about educational uses of technology. Students increasingly saw themselves as knowledgeable users of technology in educational settings. Their understanding of educational technology extended to include a practical, critical and creative perspective.

These extensions were dependent on certain conditions that were part of the technology use. Key among these were changes to the writing practices made possible with technology. Integral to the writing practices were a wide and public audience, direct links to resources, joint or collaborative construction of texts, participation in professional communities outside of the program, peer evaluation, and a shift in the purpose for assignment work. In association with the writing practices were a new set of teaching and learning relationships.

The second set of broad conditions that enabled these extensions to occur pertain to the research infrastructure surrounding the projects. This infrastructure enabled students and

instructors to participate in the design and review of the projects. This provided an opportunity for participants to engage critically with educational technologies. The experimental nature of the research also enabled participants to take varying degrees of risk in terms of both establishing new teaching practices and being willing to work through the inevitable 'ups and downs' that are part of this sort of work. This degree of risk was a key to enabling research participants to engage with the technology and critique it from being inside the practice, so to speak.

While I have argued that the use of technology did extend learning in useful ways in this teacher education context, it does need to be acknowledged that there were occasions where the technology was weak, the pedagogy flawed, and the engagement shallow. This serves as a necessary counterbalance to the above points. Key among these problems and constraints were: a lack of clarity regarding the purpose of the technology; varying levels of appropriateness of the technology and electronic resources to the tasks at hand; varying amounts of time and degrees of interest for both the completion of the tasks and for working with the technology itself. These problems when considered alongside some of the more general resource issues associated with the integration of technology into teaching and learning practices provide an important backdrop to understanding the value of educational technologies and the ways in which they can be adopted, refined or rejected.

This methodological approach, and the assumptions therein, prescribe certain limits to the scope of the research and the nature of the research claims. The value of case studies and action research has been challenged in some research circles, in particular their inability to provide valid generalisations. The purpose of the cases presented here is not to arrive at universally valid generalisations about the nature of technology use in teacher education contexts, but rather to illuminate the dynamics, the processes, of teaching and learning practices mediated by technology in one setting. Only detailed accounts of this nature can inform thinking about why some educational approaches to technology work better than others, and the particular points of the process at which improvements are necessary. In addition, unlike much quantitative research, this study is primarily exploratory. It adds pieces to a jigsaw rather than seeking a final picture.

Second, the analysis of learning and intellectual engagement is a study of social processes and not one of psychological measurement. Assessing the degree to which levels of engagement were extended through the use of technology was relative to the context, one in which making connections between theories and practices and across learning sites has been notoriously difficult, and one in which the use of educational technology is relatively new. In addition, the study does not directly compare modes of learning that use computer technologies with those that do not. The intent of the research is not to say that one mode of learning is more effective than another, or that one should replace another. While such comparisons are in many ways inevitable, and can indeed be fruitful, in this case my concern was to consider whether and how the technology could be used to augment existing teaching practices, as well as whether and how its use created a distinctive set of teaching and learning activities relevant to teacher education.

Third, to focus on social process in the way implied by the above two points is to focus on detail. Not surprisingly this raises questions about what detail is revealed and the decision making processes underpinning this. I have suggested that the use of technology is bound by a complex array of social, institutional and individual politics. In this study I provide some background to how these factors affected the general uses of technology in the CITE program. However in the analysis of each project my primary focus is on the pedagogical and institutional roles and relations between students and instructors that developed in light of the technology projects.

The amount of detail presented in each case is also limited by the available data. The three sources of data - the student texts, participant commentary and my own observations - provide considerable detail for the analysis. Yet there are also many questions that could, and perhaps should, have been asked that would have fleshed out the detail in more comprehensive ways.

Of the available data I have made decisions about what to include and what not to include. While I have made every effort to provide evidence for arguments and to check my perspective with other research participants, this is still a selective process bound by my own subjectivity, my own perspective on technology, my own position in the research

process, and indeed, the purpose and audience for this dissertation (Lee, 2000). A particular concern in relation to this has been dealing with what I call the 'desire for success'. One of the criticisms that I make of the literature concerned with teacher education and technology is that those engaged in this sort of experimental work are often overly optimistic regarding its value. There is often inadequate evidence to support claims and/or little acknowledgement of the costs and the problems. However, I fear at times that my own work can be critiqued on the same grounds. While one of my concerns has been to carefully consider the process and content of the technology related activities, I do want to acknowledge how difficult it has been to critique practices when simultaneously trying to establish them and encourage others to engage in them. The technology requires considerable infrastructure and commitment and in a sense there is a certain obligation to try and make it 'work' and to see the positive, even if simply to establish the experimental work. There is a difficult balance between being an advocate and a critic. This has been a constant tension in both designing the technology projects and writing about them.

Synopsis of Chapters

The dissertation begins with a review of the literature in teacher education that is concerned with program fragmentation - the lack of connection between program parts, the lack of communication between those engaged in teacher education programs and the implications this has for student teachers' learning. This is considered a problem in many teacher education programs. Various efforts have been made to forge connections and enhance communication in teacher education programs through uses of technology. The review of this literature reveals some important insights into ways in which communications technology has been used to build collaborative practices between those engaged in teacher education and across campus and school based program parts. However the literature falls short in specifying the conditions for learning created by technological media and their relation to the content of what is being learnt. Thus, the third section of this chapter provides a theoretical perspective on the relationship between information and communication technology and conditions for learning. This sets the background and provides an argument for the project work undertaken in this study.

Chapter Three will consider the methodological framework in which the research is set. This will include a description of the research design and the methods of data collection and analysis. It will also include a discussion of the epistemological considerations underpinning this form of action-based case study. The context for the research is described in detail in Chapter Four. I have decided to devote one entire chapter to the context. My reason for doing this is based on the assumption that the technology cannot be understood outside of its context of use. Thus the claims made are not just about technology but about its use in a context. Chapters Five through to Seven report on the three technology projects. The discussion of each project focuses on the connections that participants were able to make between ideas, people, resources and experiences through the technological media. The main part of the discussion considers the degree to which these connections provided the basis for extending student teachers' learning and intellectual engagement, particularly their ability to integrate ideas and develop their own theories of practice. The final chapter discusses the findings of the research in light of the literature and considers the implications of these findings for teacher education and for future research.

CHAPTER TWO

REVIEW OF LITERATURE

Introduction

Two issues that have been, and no doubt will continue to be, the subject of debate in the teacher education literature are the fragmented nature of many teacher education programs and the conceptual and logistical uncertainties and problems associated with the integration of information and communications technology into teacher education programs. While these are two quite distinct issues and two quite distinct areas of study in teacher education, I will argue that there are points of overlap between them and it is these points of overlap that have been useful for defining a research focus. The points of overlap lie in the talk about communication and what this means for curricular design and pedagogical practices.

The prescriptive literature in teacher education that is concerned with problems of fragmentation typically advocates ideals such as collaboration and community as a means of connecting and integrating program parts. At the same time there is considerable optimism in the teacher education and technology literature regarding the potential that the technology holds for establishing learning communities and collaborative work practices amongst those in teacher education programs. My concern is however that there is a lack of conceptual and empirical evidence especially in the teacher education and technology literature explaining the relationship between these communicative ideals and curriculum practices and learning outcomes. For example, Lafferriere (1998) describes the practices of an on-line interaction between student teachers as a collaborative knowledge building community yet it is difficult to determine both what is meant by community and collaboration and how claims made within the electronic interactions achieve the status of knowledge. When used in this way, concepts such as community and collaboration tend to lack meaning beyond 'getting on' with others. This is not to suggest that community, collaboration and the social relations central to these activities are unimportant. Rather, it is to suggest that the pedagogical practices and intellectual

purposes often associated with these concepts and with uses of technology in teacher education programs are under-specified. There is a need therefore to identify the particular discursive practices central to the intellectual life of a teacher education community and test ways in which technologies can be used to create, foster and augment these practices.

In light of this, my purpose in this chapter will be to elaborate on the literature that provides the background to the above claims. This will include a brief examination of the literature that discusses some of the generic problems in teacher education, it will also review the literature that is concerned more specifically with teacher education and technology. Integrated and associated with an examination of the literature that is focussed on teacher education I will also be drawing more broadly on an eclectic set of educational literature concerned with social practices and their relationship to learning and to technology. This literature provides the necessary theoretical background for interpreting and critiquing the teacher education literature and for beginning to develop an action research project. Central to this thesis project has been developing a framework for understanding the inter-relationship between various social, linguistic and technological resources and more particularly how those resources are, and can be, deployed to assist and extend the learning of those in teacher education programs. Teacher education in this respect is constituted as a communicative practice. That practice cannot be understood without taking account of the technologies available for communication.

The Teacher Education Context

'Revisioning', reconceptualising, redesigning, reorienting, restructuring are words commonly used in the teacher education literature by those seeking to effect change and improve practice.¹ The words, in part, are suggestive of an old practice in need of fresh ideas. Critiques of the old practice are typically concerned with recurring problems in teacher education – fragmentation between parts of programs, a perceived split between

¹ See titles of, for example, Sachs, (1997b); Wideen and Grimmer, (1995); Tom, (1997); Luke, Luke and Mayer, (2000a).

theory and practice, and a lack of common agreement between those engaged in teacher education regarding the nature and purpose of teacher education programs. The language of reform in this area often emphasises practices and programs based on collaboration, partnership, consensus, integration and coherence (Darling-Hammond, 1994; Darling-Hammond, 2000). Fundamental to the critiques and the calls for reform are issues of communication.

The work of Alan Tom (1997) is a good starting point for considering in more detail the criticisms of teacher education programs. He describes four frequently made criticisms of teacher education programs, namely, that they are vapid, segmented, directionless and impractical (p. 45). He argues that these criticisms recur in debates about teacher education in the areas of policy, program design, and public forums. The particular aspect of Tom's work that I want to discuss concerns the segmented or fragmented nature of teacher education programs.

The fragmented or segmented nature of teacher education programs typically refers to the relationship, or lack thereof, between practice-based, curriculum and 'foundational' courses within programs, between theory and practice, between content and pedagogy, and between those people participating in programs. In elaborating on these points, Tom argues that there are two reasons for segmentation. Firstly, courses or subjects are typically defined in terms of specialized knowledge and, secondly, this becomes reified in and reinforced by departmental structures within universities and colleges. Thus there is an intellectual as well as organizational force that segments courses or that means that people do not have opportunities to work together, or examine the assumptions upon which different parts of the programs are based. While Tom's work is primarily concerned with the United States, this particular focus for critique is also found in the literature from other countries, including the United Kingdom (Calderhead & Shorrocks, 1997; Furlong et al., 1996), Canada (Wideen & Grimmett, 1995) and Australia (Gore, 1995; Luke et al., 2000a; Sachs, 1997b). How these criticisms are manifest in practice and how they are tied to issues of communication will be the main concern of this section of the chapter.

Perhaps one of the most obvious and problematic sites of segmentation or fragmentation exists between the campus and school-based components of teacher education programs. Practicum experience may bear little relation to the campus-related work and vice versa. Those engaged in various program parts have different conceptions of the value and purpose that these parts serve. The following are some examples of this. School teachers are commonly reported to tell student teachers to forget the theory learnt on campus (Alexander, 1990; Sachs, 1997b). Student teachers regard the knowledge developed during the practicum as the most important, useful and worthwhile, whereas the 'theoretical' ideas covered on campus bear little relation to the 'real' work of teachers (Korthagen & Kessels, 1999). Teacher educators working in universities are often critical of an overtly technical orientation in the practicum experience (McWilliam & O'Brien, 1993; Zeichner, 1990). Herein lie the seeds of the debate related to the criticism that teacher education programs are impractical and that the campus and practicum experiences are unrelated.

The various layers of fragmentation embedded in the institutional structures and practices of schools and universities constitute and reinforce dichotomous conceptions of theory and practice, academic and school-based work, the foundational and the applied (Lowenberg Ball, 2000; Luke et al., 2000a). There is clearly little consensus regarding the purpose, conduct and content of various parts of teacher education programs, or the relationship between those parts. Rather, programs are a mix of subjects that reflect the individual whims and/or institutional affiliations of those teaching them. What these arguments suggest is that the organisational and discursive structures within faculties and schools constrain communication between those involved in teacher education and thus the likelihood of teacher educators developing, and student teachers experiencing, programs that are coherent and that have an agreed upon purpose.

Tom argues that problems related to fragmentation and integration are compounded by the ways in which large faculties in particular, conceptualise student teachers as learners:

With some exceptions, teacher educators have treated prospective teachers as if these novices were nothing more than individuals learning to teach through the personal mastery of professional content. Teacher educators generally have

ignored the social aspect of teaching in which individuals have relationships with one another and collective obligations to the overall profession. (1997, pp. 125-126)

In this respect student teachers have little opportunity to develop an understanding of the practices in which they are engaged through discussion and negotiation with others. The presupposition here being that some sort of joint or collaborative work is a necessary part of learning to be part of a professional practice and understanding the activities that make up that practice.

These criticisms of teacher education programs demonstrate a distinct lack of communication between those involved in teacher education - school-based teacher educators, university-based teacher educators and student teachers. Institutional structures and workplace cultures militate against constructive dialogue between program participants, let alone a shared understanding of the purposes and practices of teacher education programs and an integrated set of practices. These circumstances can make it difficult for students, individually or collectively, to learn the language of the various program parts and make connections between them.

However is there sufficient reason to try and bring the disparate cultures and program parts together in some way? I think the answer is yes given, as Tom in an earlier piece suggests, 'the teacher-in-training inherits the difficult task of integrating the diverse forms of knowledge and skill' (1995, p. 124). McIntyre (1990) adds to this discussion by making the following argument:

No satisfactory initial teacher education course is possible without much closer and more effective integration of school based and university based elements of the course than has been common: leaving the task of integrating 'theory' and 'practice' to student teachers has demonstrably and not surprisingly been inadequate. (p. 114)

In acknowledging this argument a further set of questions emerge – what does integration mean in teacher education contexts and what forums exist in which there could be an exchange of ideas and an effort to make explicit the relationship between program parts?

Integration then, or at the very least juxtaposition of the different sorts of knowledge and skills that are learnt through program parts, are advocated by many working in the area of teacher education reform (Darling-Hammond, 1994; Darling-Hammond, 2000; Lowenberg Ball, 2000; McIntyre, 1990). One of the key assumptions underpinning these theorists' conceptions of integration is that the nature of the professional practice of teaching is underpinned by both theoretical and practical knowledge - not one or the other.² Developing one's own theories of practice can usefully take account of personal experiences as well as existing sets of knowledge and ideas.³ Thus making connections between different sorts of knowledge and ideas, translating ideas from one context to another, putting knowledge into action and vice versa, are important parts of the intellectual work associated with learning to teach, and important parts of the means by which new knowledge is articulated, communicated, justified and learned.⁴ These views of integration do not assume that theoretical knowledge learnt at university is simply applied in the practice setting. McIntyre, for example, argues that rather than saying that one form of knowledge is more important than another or that there should be consensus across forms of knowledge, the different forms of knowledge need to be tested against a full range of theoretical and practical criteria. This is a means of justifying the practices that exist within various educational communities and that are generated through both educational research and teaching practice.

Likewise, Darling Hammond (2000) refers to Dewey to suggest that knowledge for teaching is acquired through inquiry into problems of practice in ways that draw on both theoretical subject matter knowledge and practical knowledge of teaching methods: 'Command of scientific methods and systematised subject matter liberates individuals; it enables them to see new problems, devise new procedures, and in general, makes for

² It is worth noting that it is difficult to pin down what is meant by theoretical and practical knowledge much of the time, and indeed the terms do have various meanings. My concern is that often what particular authors mean by theory and practice is not delineated which has the effect of reinforcing the theory/practice dichotomy rather than considering how theoretical and practical forms of knowledge may be related. I will elaborate on a sense of theory and practice in the third section of this chapter. Suffice at this point to say that theoretical knowing is a way of systematising and drawing generalisations about practical knowledge (Wells, 1999).

³ In saying this I am not suggesting that the tensions between theory and practice can ever be resolved, rather than the relationship between the two can be explicated.

⁴ Note, I am assuming here that learning to teach is an on-going process not limited to pre-service teacher education.

diversification rather than set uniformity' (Dewey quoted in Darling Hammond, p. 170). The intellectual engagement associated with inquiry into problems of practice is ultimately tied to the explication and justification of one's professional practice and thus forms the basis of learning about teaching (Fenstermacher, 1994). Constituting learning to teach and teaching as intellectual work has particular currency in light of recent state-based reforms of teacher education programs in many countries that, as Luke et al. argue, put the 'the position and status of teachers as intellectuals at risk yet again' (2000a, p. 3).

The mechanisms advocated to develop both integrated practices and student teacher learning are often founded on the principles of collaboration (Darling-Hammond, 1994). While I have suggested that collaboration can be something of an empty term, Grimmer's definition is useful by way of understanding its relevance to the fragmented context of teacher education that I have described:

Collaboration involves the mutual negotiation of purposes and interests by parties committed to the goal of program improvement. Each of these parties has its own interests and purposes for teacher education which, taken together, eventually emerge as the agenda for preservice preparation... Collaboration, then, is the shared negotiation of purpose and task. (1993, p. 200)

This conception of collaboration has relevance to both the work of teacher educators in program design and implementation, as well as student teachers in negotiating levels of understanding with teacher educators and peers across different courses and program parts.

Within the recent prescriptive and descriptive teacher education literature the themes of integration and collaboration recur. The strand of this literature that I now wish to turn to is the area of technology and teacher education. My concern will be to examine the research in the area that has used information and communication technology (ICT) to shape new communicative practices and pedagogies in order to address problems of program fragmentation and/or to develop integrative and collaborative practices that enhance student teachers' learning and extend their participation in some of the varied professional communities associated with teaching.

Teacher Education and Technology

As a backdrop to this discussion it is worth noting that many teacher education programs are working through the logistical and conceptual problems associated with integrating the use of ICT into teaching and learning practices. The three and in some ways related reasons that I find most compelling for integrating technology into teacher education programs are: 1. To examine ways in which ICT can be used as a tool for program integration, in other words to examine its potential in relation to developing channels for communication across program parts and amongst diverse communities; 2. To explore whether and how ICT can be used to extend the learning of those engaged in teacher education programs through opening channels for professional communication and collaboration; and 3. To introduce student teachers to the technologies and associated literacy practices that are increasingly being built into the teaching and learning practices in schools, and that are more generally a common feature of communicative practices in post-industrial societies.

In considering the potential a key question to ask is whether the communicative potential associated with particular uses of technology provide a vehicle for program reform in teacher education. Certainly there is considerable optimism in some sections of the literature regarding this potential. The work of Laferriere (1998) epitomises this optimism:

The potential is there for an entire communication process (between students, schools, undergraduates linked to different schools, undergraduates and teachers or university supervisors and professors, etc.) to create a system dominated by knowledge building and experience sharing, thus creating an environment imbued with continuous transformation. (p. 3)

While I do not think that various uses of technology in and of themselves are or will be constitutive of major program reform in teacher education, I think they do provide one vehicle for reconceptualising the communicative practices in teacher education programs that are necessary for program reform. At the same time, as indicated above, any implementation of technology opens up its own set of logistical, conceptual and methodological questions and problems. For a start there is research both within the field

of teacher education, as well as in schools, that documents how difficult it actually is to integrate technology coherently and equitably into educational practices (Bryson & de Castell, 1998b; Wild, 1996). Second, the teacher education and technology literature falls into the much larger field of educational technology. In this field there is considerable rhetoric regarding the vices and virtues of educational technologies. Burbules and Callister (2000b) characterise this rhetoric as polarised - 'boosterism' or 'rejectionism'. They suggest that such polarisation is unhelpful in critically examining how the technology is being used as part of social practice and how it can be used for worthwhile educational purposes. Third, while the optimism associated with technology is in many ways essential for the development of innovative practices, there are still many questions to be asked about the empirical evidence that might lend weight to the optimism.

With this in mind I will now turn to an examination of some specific examples of the use of technology in teacher education programs that take account of one or more of the above reasons for technology integration, particularly examples that have sought some level of program reform, and that have been developed in response to some of the issues related to fragmentation outlined in the above section. Before examining some of this literature it is worth noting the review of literature on teacher education and telecommunications conducted by Blanton, Moorman and Trathen (1998). Their broad ranging review examined a number of studies which they grouped into the following categories: implementation matters; effects on individuals and groups; the relationship between technology use and social context. They were generally critical of the quality of research. The following quotations provide a summary of their main points for critique:

There is a commitment to telecommunications on the part of the researchers that results in conclusions unwarranted by the data. (p. 246)

Finally, after completing this review we have reached the conclusion that the research is philosophically and theoretically barren. (p. 259)

Blanton et al. are less critical of those studies that attempt to examine the ways in which the construction of on-line texts and dialogue between people is more coherently linked to the 'patterns of discourse in a community' (p. 253). By this they mean studies that are seeking a fine-grained understanding of the social, technological and pedagogical factors

associated with learning to participate in various professional communities. They make the point that:

Researchers are beginning to think and talk about the need to study the culture and contexts in which pre-service teachers' learning of and with telecommunications occur. However few studies of this type exist in the literature. (p. 257)

These are the studies that I am interested in.

The studies discussed in this section have attempted to create new communicative patterns, structures and relationships using communications technology. I will focus on their reasons for doing so, the outcomes of such ventures and the various problems and possibilities associated with these initiatives. As mentioned in the introduction to this chapter, one of the arguments that I will develop through the review of this literature is that while there is a general optimism about the communicative possibilities, there is still little evidence which systematically demonstrates the ways in which the nature of interactions mediated by computer technology might add to student teachers' learning about teaching.

One of the most broad ranging studies examining technology and teacher education has been conducted as part of the Teaching Teleapprenticeship Program at the University of Illinois at Urbana-Champaign (Clift, Mullen, Levin, & Larson, 2001; Thomas, Larson, Clift, & Levin, 1996b). This was a three year project in which all participants in a teacher education program - faculty, student teachers and school advisors - were learning about and with technology as part of their own professional development and as part of their school-based teaching practice. All participants at various points in time were masters or apprentices depending upon their knowledge of either teaching or technology. While a more specific part of this program will be described in detail in the next paragraph, it is worth noting some general conclusions drawn from the project. In this study the factors affecting the 'quality and character' of technology use in the teacher education program were: degree of access to the technology; provision of technical support; purposefulness and relevance of technology training to the workplace; and the nature of the context, that is the courses, people and settings within the teacher education program. The authors of

these articles also argue that if the use of technology is to be purposeful, that is if it helps those using it achieve particular goals or solve particular problems, then it must be integrated into program parts and not exist as a separate course.

These general comments have relevance to many teacher education programs in which technology is a part and they are indicative of some of the complexity of program reform in this area. What is interesting, and also not surprising, is that much of the study is concerned with developing technology practices that are coherent across campus and school. This refers to both using technology as a means of professional learning for teacher educators and student teachers and integrating technology into teaching practice in schools. In a sense this is a two-level approach to dealing with program fragmentation. The main focus in this paper is however on the processes of implementation and not necessarily the levels of integration achieved.

As part of the larger Teleapprenticeship program, Thomas, Clift and Sugimoto (1996a) examined the use of email as a communication device in an English methods course which included an on-campus and practicum component. The focus in this particular study was on student teachers' learning with, and perceptions of, communications technology. Each of the eleven student teachers in the study was provided with a power book computer and modem. They were required to use email for some course activities on campus such as responding to set readings and preparing questions for class discussions. They also had the opportunity to use email during the practicum to send journal entries, lesson plans and observations to each other and to instructors. The authors report that the student teachers used email mainly for information and personal purposes and that the use of the technology dropped off greatly during the practicum. The student teachers in the study made varying use of the technology; some found it to be valuable and others did not.

Despite the misgivings of some of the student teachers, Thomas, Clift, et al. assert that the use of technology was beginning to change the teaching and learning practices of those engaged in the study. It varied the interaction between student teachers and instructors and the teaching practices or design of the curriculum: 'Students began to

perceive the use of computer technology as part of the job requirements of student teaching' (1996a, p. 172). The technology provided a 'communication bridge' that increased the interactions between student teachers and instructors. This in turn changed the way instructors planned their lessons and the ways in which they related campus work to the practicum. The authors also raise some issues relevant to participation in on-line communication such as the influence of an instructor and the rules that might surround this form of communication in terms of trust, obligation to respond and so on. What they are suggesting is that there were changes to the pedagogical relations and practices amongst those in this course. In their conclusion the authors are optimistic: 'the potential of telecommunication in learning to teach lies in broadening the dialogue from the traditional triad (student, cooperating teacher, university supervisor) to a wider and richer source of influences' (1996a, p. 173). Yet this is despite the fact that the main use of the technology in this project was for the exchange of course information and that many students in the study found it to be impersonal.

A study of the on-line discourses of student teachers in a distance education setting by Leach (1997) develops a similar line of thinking. As part of this study a software program that had a bulletin board and sites for discussion was used to establish, in Leach's words, an 'electronic community'. In evaluating this program Leach considered participation rates compared with other similar courses at the same institution and post course surveys. The participation rate was high and student attitudes toward the technology were generally positive. Students used the technology to communicate with other students to get personal and study support, debate issues, discuss school experience, find information and to post jokes. In accounting for this Leach raises two important points. Firstly, she argues that the interactions served a worthwhile purpose, that is they were related to students' needs during the course. Secondly, Leach ties the use of this technology to a view of social learning. She draws on the work of Lave and Wenger (1993) and others to argue that the interactions between students demonstrated in important ways the value of joint practice and learning as part of participation in a community of practice:

Socially situated theories of learning ... recognize the way in which knowledge is created and transformed at the intersection of dialogue between people ... From this perspective the process of becoming a teacher is not a one-person act; it is a

process of increasing involvement in a 'community of practice'. (Leach, 1997, p. 69)

Obviously these are crucial issues in a distance setting, but the principles of learning that Leach raises also have relevance to campus based teacher education programs because the problems associated with fragmentation are so pervasive. It is in the practicum, where students may be in isolated contexts, that this sense of fragmentation is most obvious. For this reason it is of value to consider the work of Schlagal, Trathen and Blanton (1996). They used technology to create a teacher education 'community'. They established email links between teachers, faculty and student teachers during the practicum. This was a deliberate attempt to overcome some of the problems of fragmentation between campus and practicum experience and the isolation and singularity of school experience. Indeed these authors go so far as to say 'Isolated from the instructional conversation of teacher preparation they [student teachers] develop meanings of their experience in idiosyncratic and uncritical ways' (p. 176). In their study student teachers were required to post two emails each week to other class members and instructors and had time allocated to them during the practicum to do this. In a way similar to Leach's study the students used the email for various purposes - responding to class assignments, social and emotional exchange, housekeeping and 'spontaneous, sustained exchange of ideas' (p.178). As an example the authors mention an exchange between a student and the language arts instructor about spelling. They make the point that the public nature of this discussion meant that everyone who was on the email list could participate and learn through the exchange. On the basis of this study the authors argue that the public dialogue became critical to the student teachers' professional development, again by locating it within a community of practice:

These exchanges illustrate the capacity of electronic mail to create a community of discourse with the potential to strengthen and vitalize teacher preparation.

Opening paths of communication among professors and interns adds to the quality and quantity of contacts with students and their classrooms. Without the connections email made possible, we could not have responded to issues as they arose or helped students to conditionalize their course knowledge in field placements. (1996, p. 181)

In talking about the use of email the authors raise some important pedagogical points. Firstly they suggest that the email provided a communication bridge between the campus and practicum-based components of the course and a means for helping students to distinguish between 'common' and 'unique' aspects of their classroom practice. More specifically the use of email was structured in such a way to promote 'reflective dialogue'. This was done by providing open and thematic discussion starters which provided some direction for the postings and time to write. In this respect their aim was to tie the use of email to the goal of encouraging group reflection. The authors of this paper claim that this program helped to establish a particular sort of community practice. Building community, through the technology, became a part of their pedagogy. What is interesting in this study is the way in which this form of communication was built explicitly into the practicum curriculum. Time was allocated to participate in the on-line communication rather than it being an expectation that was imposed on top of other requirements. The authors do note however that only a few teachers participated in the on-line discussions, precisely because of time constraints.

The notion of professional community is also one developed in the research that is part of the National Telelearning project in Canada (Breuluex, Laferriere, & Bracewell, 1998; Laferriere, 1998; Laferriere, 2000). These researchers are concerned to establish professional development communities in teacher education programs by using available web-based technologies. During practicum experiences students contributed to on-line journals. Participants built on each other's reflective comments to document their learning in ways that have transcended the confines of an individual classroom. The authors make three interesting observations about participation in these on-line discussions. They say that the role of the on-line facilitator is crucial in order to link the 'physical and virtual worlds'. They also suggest that there is a need to clarify an expectation to participate and that there is a need to specify complementary roles and responsibilities in the on-line discussion. In saying this they are pointing to changing and new ways of thinking about pedagogical roles and relations.

Breuleux et al. (1998) provide a conceptual frame for their work:

Establishing communities of learners around the teaching professional and student teacher supported by networked computers is one major component of the new model we are designing. As we implement this model, within each learning community, high school learners, student-teachers, school based and university based teachers are interacting in increasingly differentiated ways. As in other communities of learners, we base our design on agency, reflection, collaboration and culture. (p. 4)

Specifying the contextual and conceptual factors underpinning the design of projects is useful. What is not clear from this report is how these factors are played out within particular pedagogical practices and how the engagement between those within the practices is 'differentiated'. This differentiation is important to document.

The concept of a community of learners is likewise raised by Le Cornu, Mayer and White (2000). They argue that the use of ICT during the practicum changed the nature of the supervisory relationship between university instructors and school teachers. Their concern was to document the effects of this - both good and bad. The public nature of the on-line discussions, the different 'space' in which the discussions took place meant that university instructors recreated their roles - less of a supervisor and more of a facilitator and moderator. Likewise student teachers took on different pedagogical roles through the public exchange of ideas. While Le Cornu et al. acknowledged that the technology could be used to develop new pedagogical practices for the practicum, they also pointed to the 'risks' associated with such developments. In so doing they outlined some of the micro-politics of on-line settings, raising questions about power and ethics in relation to the nature of participation. They present their point of view as instructors and practicum supervisors in these on-line discussions. However while the authors talk about changed relationships and new social politics they provide next to no detail or evidence of the ways in which the relationships and politics were played out in practice. There is no examination of texts or participant reactions to the electronic exchange that illustrate either aspects of participants' relationships or the effects on learning.

One of the features of both the Telelearning and Teleapprenticeship programs is the duality of purpose - the technology is both an object of study (how it can be used as an educational tool in schools), and a medium for teaching and learning in teacher education programs. Moreover, the intent is that student teachers can apply the principles of technology use in their own classroom practice. There is thus a tight set of connections and attempts at integration that focus on technology use in educational settings. A recent study by Kapitzke (2000) documents a similar case in an educational media and technology course that is a required part of a teacher education program. The sorts of connections sought through this campus-based course are with the applications of technology in school classrooms and, more broadly, modes for communicating in 'media saturated' societies. This study documents the use of a range of on-line technologies and the pedagogies associated with that use. The study provides a useful contrast to those discussed above which focus primarily on email and bulletin board discussions. What is also noteworthy about this study is the clear explication of a theory of technology and how this relates to a critical theory of pedagogy. I will return to aspects of Kapitzke's theoretical framework later in this chapter as well as in the next chapter.

Kapitzke describes the class environment as one in which the 'pedagogical centre' has shifted from 'teacher with print materials to computer screen with other students' (p. 220). The course combined face-to-face and electronic modes of communication. A course web-page was the 'portal' for all course information, class notes, assignment details and on-line communication. As part of their participation in the course students individually and collectively designed their own webpages, evaluated school web-pages, reviewed search engines and web-sites relevant to one curriculum area, and participated in electronic discussions by way of responding to their experience of 'cyber education'. The strength of Kapitzke's work is that she details the particular pedagogical environment that was created. In so doing she begins to document students' learning, their perceptions of themselves as users of technology, and the implications this has for working with technology in schools:

A shift was evident in the self reporting of students from being technologically unskilled and anxious, to being competent and sufficiently confident to transfer

newly acquired knowledge to different contexts (e.g., 'in classroom situations').
(p. 222)

Much of the learning was focused on what Kapitzke calls 'technoliteracy'. She suggests that the iconographic and multimodal nature of much on-line activity is both diverse and complex. This technoliteracy is fundamental to much of the design work that is associated with the web. Kapitzke goes on to say that this sort of work encouraged 'cognitive and social interactivity, collaborative authorship and problem-based learning' (p. 223). She reports that students were motivated by this creative work. Students also reported being more adept at using web-based resources.

Kapitzke does acknowledge however that the e-tutorials were not successful. There were low levels of participation and the intellectual content of contributions that were made was also low. There is little by way of explanation to account for this, and my presumption is that the tutorial was not mandatory. It is also unfortunate that Kapitzke did not describe in more detail the processes and outcomes associated with the web and search engine review assignments. This may have provided some insights into the relationship between this course and curriculum subjects that students were taking.

One of the concerns that I have about this study, and this links to the comments that I have made in the previous paragraph, is that Kapitzke makes bold statements about the pedagogical practices and their value without sufficient warrant. For example, she states that a global learning community emerged on the basis that one student's website had been found and referenced by a teacher education student in England. Furthermore, she argues that the pedagogical practices associated with the self-directed learning that had been set up in this course allowed for the 'Collaborative critique and construction of social, cultural and technological languages, knowledge, and identities' (p. 227). While I think she has presented some evidence that the practices enabled students to construct particular language, knowledge and identities in collaborative ways, to my mind there was no evidence that showed how students engaged in any critical or reflexive examination of these practices. Moreover, I think that Kapitzke falsely assumes that lessening the authority of the instructor and placing more responsibility for learning in students' hands is, or leads to, critical practice. It may lead to more engaged practice and

more meaningful learning, but not necessarily an examination of the assumptions upon which that learning is based. Likewise, by setting up a dichotomy between 'traditional' classroom practice and 'critical cyber pedagogy' Kapitzke does not acknowledge that many 'student-led' and 'critical' practices take place without any form of new technology.

The above studies provide some indicators of the ways in which communications technologies have been used to support student teacher learning in teacher education programs. What is distinctive about these studies is that the technology is used as a means of addressing a communicative and/or pedagogical problem that in some way relates to the issues of fragmentation discussed in the first part of this chapter. Furthermore, each of these studies does, in one way or another, assume the importance of social relations and social interaction in learning to teach. These social relations become contextual variables that are essential for understanding the changing nature of pedagogical relations associated with the use of technology and associated with the means by which students learn to participate in relevant professional practices. Hence the recurring theme of a community of learners, with each study providing insight into the social relations and technological conditions in one particular context. This level of documentation is important and indicates that using the technology does enable new forms of pedagogical relations to develop. However, the literature falls short in two related areas. First, there is often little evidence to support the claims made about the value of the uses of ICT. Second, the literature often fails to make explicit the relationship between the pedagogical processes that are mediated by the technology and any extensions to participants' mastery of the discourses and their understanding of the problems and issues being addressed through the process. By this I mean that there is an emphasis in the literature on the process of interactions without adequate attention to the content and outcomes of the interactions. The virtues of collaboration and community are expounded without sufficient consideration of the goals that these practices are purported to serve, or of the evidence which might suggest that they have been met. What is missing is the evidence to show what it is that students are learning and how that affects their participation in and understanding of the relevant professional practices.

In saying this I do not want to discount the importance of the process, but rather to suggest that its importance lies in understanding its relationship to the nature of what is constructed. Thus it would be useful to examine the ways in which different ideas, resources, forms of knowledge and experience are integrated through collaborative processes and to consider the degree to which this integration might assist student teachers to more adequately participate in the professional discourses associated with being a teacher. This, as I will argue in the next chapter, could be achieved through a closer examination of the actual texts that participants in these projects produced. The key assumption here being that analysis of a text can be revealing of both the process and product (Halliday & Hasan, 1989). The feedback provided by students and instructors has formed the basis of many of the above research claims. A detailed analysis of the texts mediated by the technology could usefully complement this feedback.

Related to this general critique of the existing literature, the following points are also worth noting. The studies above have examined the integration of technology into a single course and have focussed particularly on connections that can be made between campus and practicum. However there is little in the literature that documents the ways in which communications technology might be used as an integration tool at a broader programmatic level, that is across and within a number of courses. Furthermore, and this may also be related to the rapid changes associated with web-based technology, there is little in the literature that examines how resources and ideas developed by those outside of programs can be built into the interactions between program participants. I am thinking of, for example, the use of the vast amounts of material that are now located on the web, participation in public electronic forums and list-serves associated with educational matters, and the inclusion of outside participants into the design and implementation of activities mediated by technology.

One final point is of note when examining this set of research. All of the researchers were also program participants, often with teaching responsibilities, often with visionary views of technology. On the whole I think this is positive in educational research and necessary to effect change. There is some attempt to address problems, to improve practice in one's own backyard, so to speak. The dangers associated with this are that the perspectives

presented are those of technology enthusiasts. This can constrain the critical perspective that sometimes needs to be brought to bear on this topic.⁵ Moreover, such a perspective does not show how a broader spectrum of teacher educators might learn to use technology as part of their pedagogical practice.

Theoretical Framework

The Relationship between Technology, Education and Social Practice

The above discussion presupposes a particular view of technology, social practice and learning. In this section of the chapter I want to provide the background to these views. Here I will elaborate on some of the theoretical ideas that have informed my critique of the above literature and shaped the design of the research project reported in this thesis.

In the first instance I wish to develop a framework for understanding the relationship between social practice and communicative technologies. Articulating a relationship between social practice and technology provides a basis for understanding existing patterns of social interaction, as well as for changing patterns of communication and technology use. More specifically it provides a basis upon which to consider and take some responsibility for using technology as a communicative tool that is part of curriculum and workplace reform in teacher education, especially for addressing endemic problems associated with program fragmentation. In this respect my concern is to outline a framework that locates computer technology within social practice, rather than seeing it as something external to or responsible for social practice. Much has been written in recent times about 'technological determinism' by way of rejecting some of the simplistic claims made about technology as a cause of social practice and as the means for improving educational practices.⁶ Franklin (1990) argues that technology is practice.⁷ She uses the following analogy to explain:

⁵ As mentioned in Chapter One, this is an issue that I have struggled with in this study. I will discuss it further in the next chapter.

⁶ These claims are particularly common in the sales pitches and rhetoric as well as the assumptions underpinning some of the early research. Snyder (1998), for example, documents ways in which the focus for research in technology and education has changed over the last decade.

⁷ Franklin is talking about all technology and not just computer technology.

I think it important to realize that technology defined as practice shows us the deep cultural link of technology, and it saves us from thinking that technology is the icing on the cake. Technology is part of the cake itself. (p. 17)

In this respect any attempt to understand, or indeed, shape social and educational practice requires taking account of the available technologies.

Other writers, working in a range of disciplines, make similar points with a more specific emphasis on communicative technologies. Kress (1998), for example, argues that:

We know that it is both a common and serious error to treat technology as a causal phenomenon in human, social and cultural affairs ... Technology is socially applied knowledge and it is social conditions which make the crucial difference in how it is applied. (pp. 53-4)

Likewise, Shields (1995), in a discussion of technology in university settings, rejects the way that computer technology has been reified:

Typically reification leads to one form or another of technological determinism, in which specific concrete, observable and usually quantifiable aspects of an artifact – its technical attributes – are selectively isolated as independent variables, which are then said to account for the causal or explanatory power of the *whole* technology. (p. 6)

Shields argues, rather, that it is important to view the use of technology in particular contexts as socially constructed and as constructed by people with some degree of agency. Thirdly he argues that there is an 'indeterminacy' in the relationship between the technical and the social. This sense of indeterminacy is also picked up by Burbules and Callister (2000b) who talk about a 'relational' view of technology: '...we never simply use tools, without the tools also "using" us. We never use technologies to change our surroundings without being changed ourselves' (p. 6).

In a similar vein, Bertram Bruce (1997) uses the term 'sociotechnical' practice to describe what he sees as the inter-relationship between technology and social practice. With reference to literacy as a form of social practice he argues that:

We cannot begin to understand the role of technology in literacy if we set it apart as 'only a tool'... Any technology is deeply intertwined with social relations, in terms of its construction, distribution, use and interpretation. (pp. 302-303)

By way of example Bruce describes the particular uses of communications technology in three universities in Australia, China and the United States to explain the term 'sociotechnical' practice. Each institution had access to personal computers, Internet connections, software for email, for connecting to web servers and for browsing the World Wide Web. That is, each institution had the same 'physical devices'. Bruce argues, however, that each institutional context, its 'histories, ideologies, pedagogical philosophies, and financial resources', have led to quite different applications of these devices and consequently, quite different literacy practices and quite different communicative patterns. For example, at one institution the use of the technology was 'utilitarian'. People were using the technologies in ways that did not radically change existing teaching practices based on lectures, seminars and library assignments. At the second institution the use of the technology was 'transformative'. Every course was web based and email was used as a point of contact for students and instructors. Bruce describes how this had various levels of effect – students used web page resources rather than the library reserve, students submitted assignments through email or web pages, email was built into course activities. He argues that technologies, used in this way, had the effect of changing relationships, redefining coursework, instruction and assessment and promoting a different conception of learning (p. 297). The two institutions described thus far were in the United States and Australia. The third institution was in China, and Bruce describes how the level of technical expertise as well as the degree of political control over the technology was significantly different from the other institutions. For example, the use of email was heavily regulated, yet at the same time students used the email as a means of subversion. Likewise the government of the day limited the degree of access to the World Wide Web. While Bruce's study is very general, it nevertheless serves to illustrate the interrelationship between the communicative technology and the social practices of which it is a part.

The point that Bruce makes in this, and other related papers (1999; 1998; 1993) is that there is a need to examine technology innovations in real settings and this requires taking

account of patterns of technology use in relation to, amongst other things, the social politics, personal values, institutional discourses, disciplinary expectations, and available resources in any given context. In other words and as Bruce and Hogan (1998) put it: 'To understand what a technology means, we must examine how it is designed, interpreted, employed, constructed, and reconstructed through value-laden daily practices' (p. 279). This they argue is a prerequisite to understanding whether a technological innovation extends learning. This point is corroborated by the ideas developed by Kapitzke (2000). She too, argues that technology is practice and on the basis of this conducted her research as a case study because it provided a means for examining the context specific features of the practice, the 'material and cultural conditions of learning' (p. 212). Deibert's (1997) work goes one step further in specifying features of the relationship between communications technology and social practice. He argues that "the communications environment affects not just social organization, but also the "internal" world of ideas and ways of thinking' (p. 33). In other words the medium plays a part in how ideas are represented and how knowledge is constructed. This provides a useful backdrop for a discussion of writing and design that I will turn to later in this chapter.

This perspective on the relationship between technology and social practice provides an important backdrop to both designing and understanding the uses of technology in educational settings. Yet design of technology use in educational settings also benefits from a more specific conception of how that use might extend teaching and learning practices. The value of the technology and teacher education literature is that collaboration and community are identified as conditions that support learning. However, as I have previously suggested, there is a need to make explicit the nature and effects of the pedagogical practices associated with technology beyond claims related to collaboration. To this end I will now turn to some ways of conceptualising technology in relation to pedagogical practices.

Bruce and Levin (1997) draw on Dewey's (1943) ideas regarding the 'impulses' to learn in order to develop a four part taxonomy of educational technology. They use four categories to describe the ways that technology can be used to mediate learning. These are communication, inquiry, expression and construction. The activities implicit in these

four categories represent what Dewey thought were the 'impulses' to learn. They also provide a framework for analysing educational uses of technology. Bruce and Levin go onto describe how particular types of technology use and particular kinds of software can fall within these related categories. While the terms are general and the authors acknowledge the overlap between categories, this taxonomy provides one way of thinking about the sorts of processes and interactions that can be mediated by technology and how teachers might integrate technology to support and extend engagement in any particular learning activity.

Talking specifically about the Internet in relation to educational opportunity, Burbules (2000a) makes the following comment:

Increasingly, the Internet is a *working space* within which knowledge can be co-constructed, negotiated, revised over time; where disparate students from diverse locations and backgrounds, even internationally, can engage one another in learning activities; where collaborative projects can be developed; where communities of inquiry can grow... Such activities are not just supplements to the classroom experience; they are unique irreplaceable learning opportunities themselves; *and often they only exist online, not in 'real' classrooms.* (p. 275)

Three points central to both the technology and learning are the collective possibilities, the opportunity for revision over time and the pluralism made possible within a virtual space. Burbules and Callister (2000b) likewise discuss the development of on-line communities and what this means for education. Their point is that the 'working spaces' of the type described above are becoming an increasingly taken for granted part of the activities within educational institutions. In other words they are the educational practice. At the same time many other news groups, list-serves, and electronic publications enable participation in educational communities beyond those formalised by schools and universities.

Burbules and Callister also mention writing and publication in relation to on-line learning. Their claim is that 'writing and publication become the conditions of community; both through the process of collaboratively writing and composing publications, and through the networks of distribution through which they are shared' (p.

166). This raises questions about the part that writing plays in the learning process which I will discuss in more detail later.

Broadening the discussion to multi-media, Kress (1998) and the New London Group (1996) talk about 'design' as the principle of meaning making in those contexts where there is a multiplicity of communication channels. Their argument is that in learning to be part of particular communicative and textual practices people are not simply users of a stable system of language, but are 'remakers' and 'transformers' of representational resources. This they argue calls for a new pedagogy, one in which design, using multi-modal forms of communication, is fundamental (New London Group, 1996, p.65).

Three key assumptions underpin the above perspectives. First, associated with the use of technology are new forms of text, new ways to represent and communicate ideas and different patterns of social interaction. This creates new communities of practice which people can learn to be part of and which educational institutions need to be responsive to. Second, there is a direct pedagogical potential that is part of the communicative uses of technology. Uses of technology can be designed to support teaching and learning in educational settings. A third and overarching assumption is that learning is mediated through particular forms of social interaction. I will elaborate a little on this third assumption because it provides useful background to what is often glossed over as collaboration and community. As well it provides a framework for both understanding and embedding technology into teacher education programs in ways that seek to extend student teachers' participation in relevant professional and academic communities.

Learning as a Social Process

A view of learning as a social process has been developed in a range of disciplines - psychology, linguistics, philosophy - and has been elaborated on in the theoretical work of, amongst others Dewey (1938), Vygotsky (1978), Halliday (1989), Lave and Wenger (1993), Shulman (1999) and Wells (1999). Although obviously there are different disciplinary perspectives, a common underlying thread is that one learns through participation in social practice and by becoming a member of, as Lave and Wenger put it, a community of practice. Participation in any practice requires some understanding of its

purpose and mastery of the tools and resources associated with the practice. Moreover, learning to participate in a social practice, of necessity involves on-going interaction with others also engaged in the practice.

The theories of learning developed by Gordon Wells (1999) have been especially useful by way of specifying the links between thinking, mediational tools, social interaction, collaboration, ways of knowing and participation in practice.⁸ While most of Wells's ideas are pertinent to school education, they also have relevance to teacher education contexts and also to educational uses of technology. Wells presents a perspective on learning by suggesting the following:

... the object of all this learning is not just the development of the learner's meaning potential, conceived as the construction of discipline based knowledge, but the development of resources of action, speech, and thinking that enable the learner to participate effectively and creatively in further practical, social and intellectual activity. (p. 48)

Such a conception has particular pertinence to professional courses of study, which have as their goal participation in a set of professional practices. His statement has coincidental relevance given common conceptions of teaching as physical, emotional and intellectual work (Sachs & Groundwater Smith, 1999). The learning task for student teachers is to extend their mastery of the various disciplinary and pedagogical discourses associated with education and teaching. It is important to note the New London Group argument: that mastery develops through more than immersion in a practice. Their point is that mastery also accrues through specific pedagogies that encourage a reflexive stance on practice. By reflexive they mean a 'conscious control and awareness' of one's actions, the ability to critique the values underpinning what is being learnt, and to 'enact' knowledge in practice (p. 84). This dovetails with the literature on critical reflection so commonly talked about in teacher education settings and which forms the basis of teachers' intellectual work (Grimmett & Erickson, 1988). Yet, what is often unclear in

⁸ Wells draws heavily on Vygotskian theories of learning and Hallidayan systemic linguistics to develop his ideas.

the literature is the relationship between reflexive practice and the development of theoretical and practical knowledge, and how this relationship is dependent upon a process of social inquiry and negotiation.

The problem in teacher education, as discussed previously, is that much of what is learnt on campus does not seem to bear a relationship to the social, practical and intellectual aspect of work in schools and vice versa. This leads of course to the unfortunate dichotomising of theory and practice, or as Wells puts it, a 'wedge between decontextualised knowing and situated knowing'. Wells's work again, offers some useful insights into ways in which the relationship between theory and practice can be conceived. He argues that theoretical knowing is not an end in itself but derives from and informs knowing that develops through practice. Theoretical knowing is a way of systematising and drawing generalisations about practical knowledge. Further, theoretical knowing presupposes some form of reflection on, and level of understanding of, participation in a practice. This leads to two related questions in pre-service teacher education. First, what use can student teachers make, if any, of the existing bodies of theoretical knowledge derived from research? And, second, how can student teachers develop their own theoretical knowing in ways that derive from and inform practice?

Three ideas that Wells (1999) develops on the conditions that support knowing, learning and reflection provide some help in thinking about how to respond to these questions.

First he suggests that:

Knowing is not an activity that can be undertaken in isolation, either from other people or from the culturally produced artifacts that provide the mediational means. (p. 76)

Thus collaborative and collective processes are important by way of negotiating meaning and justifying claims. Wells insists however, that this is more than just sharing, rather a sense of progression and building of ideas and understanding is required (p. 112). At the same time there is a presumption that this process of negotiation involves reference to existing sets of literature, as well as the cultural tools and resources that structure ways of thinking and communicating. This resonates with much of the teacher education literature

previously discussed, but I think helps to flesh out the nature of the collaborative process for learning purposes. With reference to uses of technology in teacher education programs, Wells's ideas provide the basis for asking questions about not only the ways in which the technology can be used to support collaboration, but also the access it provides to resources, and nature of the genres that have developed with its use.

The second point from Wells is the opportunity to link past experience with future action. He argues that much knowledge stays at the level of information, with little impact on students' understanding. What is needed, Wells argues, is a process of collaboration that enables students to test the relevance of information 'in relation to their personal models of the world and, where possible, its practical application in action' (p. 90). This is a key aspect of integration and ties in with the comments made by Wideen, Mayer-Smith and Moon, (1998) who argue that opportunities need to be created to enable student teachers to examine their beliefs and personal theories in light of their experiences in teacher education programs. These ideas provide the basis for an empirical analysis of the connections that student teachers are able to make between the electronic texts that they construct and their past experiences and future teaching practice.

Third, and this point is not taken up in the teacher education and technology literature, is the function of writing as part of the pedagogical process and of the construction of knowledge. Writing is the dominant mode of computer mediated communication. Wells offers some valuable insights with respect to writing:

Creating a written text is a particularly powerful way of coming to know and understand a topic that one writes about. Especially if one uses the writing, not to report what one already understands, but to come to understand in and through the process. The same is true of reading another's text, if one treats it dialogically as a 'thinking device' and not simply as a univocal transmitter of the writer's message. (p. 128)

Writing therefore is not only a means of recording information but it also serves a reflexive function. It is a thinking tool for oneself. It is also a thinking tool as one considers how to make ideas comprehensible to readers. Wells also mentions that the abstraction associated with writing lends itself to theorising, of stepping back from and

reflecting on something. Likewise, the particular forms of written genres act as tools for various forms of thinking. The permanency of written texts also means that they can be read and reviewed by others.

As Wells and others, e.g. Scardamalia and Bereiter, (1996) suggest, the particularities of computer mediated writing can be drawn on in ways that are supportive of social learning. For example, computer mediated communication such as email often contains certain qualities of both speech and writing (Kress, 1998), and so the reflexive qualities of writing and the collaborative and dialogic qualities of speech can be brought to bear in one medium. So too, the hypertextual nature of on-line writing means that texts can be jointly constructed and web resources can be directly tied into the text. Linked with the notion of joint construction is a sense of audience for web-based texts. The reception of a text by an audience makes the process of writing a clearly social one. In many educational settings students write with no apparent audience and/or an audience of one - the instructor. The fact that the web is an easy place to publish to an audience is, in this respect, important. Kapitzke (2000) also points out that on-line texts such as web pages, as well as the design space of a computer screen, enable groups of people to work together on projects. Two people can, for example, work at a computer to jointly design a web-page. Furthermore the writing/composing process can be rendered more complex through the use of other communicative modes and icons. Kapitzke describes the process as 'click and think' (p. 223). This links to the notion of design that Kress talks about. The multi-media capabilities of many new computer technologies enable a constant remaking of representational resources. These points provide another entry point into analysing the nature of the reflexive practices that might emerge through the use of ICT in teacher education.

The central pedagogical motif that Wells discusses is a community of inquiry. The above ideas help to articulate some of the teaching and learning practices that might be part of such a community. In talking about scholarship Shulman provides some further specifications for such a community. The conditions that he advocates for inquiry include that the object of inquiry be public; critically reviewed by others in the community; and used and built on by others (1999, p.15). It is worth noting that the concept of a

community of inquiry has been picked up not only in the teacher education literature (Sachs, 1997a), but also the cohort program in which this research is located. In a teacher education program the purpose of the inquiry is to develop, communicate, justify and learn knowledge about teaching and being a teacher. The substantive seeds of that inquiry are often seen to reside in making connections between theory and practice, research and experience, reflection and design and so on. Implicit in this process is being able to translate and transform actions and ideas in a range of contexts and in ways that are educationally and ethically defensible. This is consistent with the ideas raised earlier by Darling Hammond (2000), McIntyre (1992) and Fenstermacher (1994). Wells's and Shulman's ideas provide points of entry for designing teaching and learning activities, developing criteria to evaluate those activities and collecting data which might illustrate whether the activities extend student teachers' intellectual engagement with the subject matter.

Conclusion

My concern in this chapter has been to consider both conceptual and empirical literature that pertains to ICT, pedagogy and teacher education. A key assumption is that the technologies used to mediate social processes are important factors underpinning the nature and type of learning in any given educational setting. Therefore designing and understanding teaching and learning practices requires taking account of available technologies. I have suggested that the literature in teacher education and technology is beginning to explore the potential associated with new forms of communications technology, and it is doing this in ways that address on-going problems in teacher education. I have argued, however, that there is a need to be much more explicit about the pedagogical practices that are being developed with ICT in teacher education programs. Talk of collaboration is vacuous unless there is evidence to show how it actually assists student teachers' understanding of and participation in the relevant professional and academic practices that are part of their teacher education programs. Furthermore, there is a need to demonstrate whether the communicative practices made possible through uses of technology might add in substantive ways to the connections that student teachers are

able to make between those disparate and fragmented parts of teacher education programs. These connections are fundamental to the intellectual work of teaching.

This argument calls for experimental or action-based research to develop and evaluate uses of technology in ways that might extend learning and levels of intellectual engagement in teacher education programs. It also calls for fine-grained case studies and methods of analysis that can examine the relationship between the social context that underpins the use of technology, the pedagogical practices associated with that use and the artifacts of learning produced by those engaged in the process. The following chapters detail one such research project.

CHAPTER THREE

METHODOLOGY

Introduction

The central research question - How can technology be used to extend learning and the levels of intellectual engagement in a teacher education setting? - has guided the research methodology in two important ways. In the first instance some technology-based projects needed to be developed in order to examine the effects of technology use on learning practices in a teacher education program. For this reason an action research methodology was employed. Second, given the context-specific nature of technology use and the desire to sustain that use, the action took place in one setting over a period of three years. As such the research is also an in-depth case study of technology integration and associated changes to teaching and learning in one teacher education setting. More particularly in this thesis, three specific technology projects are evaluated. Each project is thus a smaller case study that exists under the umbrella of the larger three-year project. The methodological underpinnings of both action research and case study methods will be briefly considered and their relevance to the purpose and process of my thesis research will be discussed. In association with this, the means for analysing and evaluating the pedagogical practices in each case study will be presented.

There are four sections in the chapter. The first part will provide an introduction to the theoretical underpinnings of the methodology adopted. The second part will describe the research context and participants. The third part will describe the stages of the research. This will include a detailed overview of the methods used to analyse the data. The final part of the chapter will deal with some broad-brush epistemological questions related to this approach to research.

Case Studies and Practitioner Research - Purpose and Relations

A case study is, as the name suggests, an investigation of a particular event, person, situation, context, or practice. Most case studies are located in an interpretative tradition of social science research in which the researcher is a disinterested observer, seeking to examine the subjective realities of the research participants. The purpose of studying a case, in this respect, is to give a situation meaning, to understand and explain a situation or a practice, to give reasons for why things are as they are (Atkinson & Delamont, 1986; Stake, 1994; Stake, 2000; Walker, 1980).

However, my intention here is to elucidate a specific form of what I take to be case study research, namely studies of particular cases or practices which seek to change as well as explain the practice under investigation. For this reason I will discuss case study research in which the researcher is a participant in the practice under investigation; where there is an intervention, action or effort to improve the practice that is being investigated; and where those involved in the practice are collaborators in the research. These factors are central parts of the 'case', the practice to be investigated in the research project reported in this thesis. My argument is that these specifications to the study of a case have relevance to educational practice because they provide an opportunity to examine, critique and change the means and ends of the practice. They also serve to underpin, if not strengthen, the credibility and utility of the research.

More specifically, given the arguments outlined in the previous chapter, action based case studies are well suited to the research and development concerned with educational uses of technology (Bruce, 1997; Bruce & Rubin, 1993; Kapitzke, 2000). The use of technology is an implicit and integral part of what Kapitzke (2000) calls the "material and cultural conditions of learning" (p. 212). The use of technology is thus bound by individual backgrounds and motivations of the participants, and the social and institutional politics and resources within any given setting. Seeking to understand and change the practices within a teaching and learning context requires taking account of both individual values and beliefs and the institutional discourses that shape and reflect those values and beliefs (Kemmis & McTaggart, 2000).

For the theoretical background to action-based case studies I draw primarily on the work of Schon (1987; 1991), Carr and Kemmis (1986) and Kemmis and McTaggart (2000). Their work has been especially influential in the field of critical action research, participatory action research and practitioner research over the last fifteen years or so. Their work provides a substantial foundation and rationale for this type of research. In the technology and education research I have found the ideas developed by Bryson and de Castell (1998c) to offer useful methodological insights into the problems that are specific to research concerned with educational technologies. What is of note in their work is an emphasis on critiquing the social conditions associated with technology use and the development of practical strategies which seek to address inequities that are part of those social conditions.

Action research, as discussed by Carr and Kemmis, is a cycle of investigation into a practice by a practitioner seeking to change the practice. It has an emancipatory and critical agenda. Schon's work is concerned with reflective practice as a method of research that takes place in the practice. Reflective practice is a means of generating knowledge that is useful to the practitioner. Like action research, the reflective practice that Schon talks about is a cyclical investigation of both the means and ends of a practice. Schon's notion of reflective practice does not have the broad critical or political dimension of the type of action research advocated by Kemmis and Carr and Kemmis and McTaggart; rather it seeks to resolve problems implicit in the action of professional practice. Given the current state of affairs in technology and education, where there are gaping equity issues associated with technology use and where there is considerable uncertainty regarding how technology can be used as part of pedagogical practice, the time is ripe for some form of research that enables practitioners to address these issues in ways appropriate to their context.

Educational Practice/Practitioner Research

An examination of educational practice is a good starting point for considering methods of educational and practitioner research. Carr and Kemmis make the following statements

useful for illuminating the nature of educational practice as it pertains to educational research:

(Education) is a practical activity, the purpose of which is to change those being educated in some desirable ways. One extremely important consequence of the practical nature of education is that educational research cannot be defined by reference to the aims appropriate to research activities concerned to resolve theoretical problems, but, instead, must operate within the framework of practical ends in terms of which educational activities are conducted. (1986, p. 108)

Their point is that the nature of the practice is a crucial determinant of the types of questions and methods used to research a practice. In the context of this study, the practical ends associated with learning to be a teacher, and developing connections between people, ideas and courses to support learning, have guided the research. Developing practices that seek to extend learning have taken place in response to ongoing tensions within teacher education programs outlined in Chapter Two, and by utilising information and communication technology (ICT). More broadly, the increased importance of computer technology in varied social settings is reflected in educational practice in ways that demand a response by teacher educators. The purpose of this research then, has been to move beyond what might be considered anthropological, and elucidate knowledge that has relevance to, and is useful in, a practice setting.

Carr and Kemmis go on to explain why any research concerned with educational practice must take account of the theories of practitioners:

Since educational practitioners must already have some explicit understanding of what they are doing and an elaborate, if not explicit, set of beliefs about why their practices make sense, they must already possess some 'theory' that serves to explain and direct conduct. This entails that it is impossible for any researcher to observe an educational practice without reference to the mode of understanding employed by the educational practitioner. The very identification of an educational practice depends on understanding the framework of thought that makes it count as a practice of that sort. (p. 111)

Schon concurs. He argues that knowledge and theories about the practice are best developed by those in the practice. The practice according to Schon is the 'swampy lowland', it is complex, messy, ill-structured and unpredictable. Knowledge developed on the 'high hard ground' of formal scientific research and through 'technical-rational' methods, is according to Schon, not relevant to the nature of professional practice. Such research does not take account of the complexity of a practice context. It is only concerned with the means to preordained ends. An important assumption here is that understanding a practice requires taking account of the theories of practice held by those in the practice. A theory of practice in the case of teaching is typically an amalgam of empiricist, technical and scientific knowledge, of moral and social norms and values and of pedagogical traditions (Chambers, 1992).

Given this I will turn now to an examination of the context in which this research takes place. This will include a consideration of the participants in the studies, how their theories of practice have been brought to bear on the process of research as well as how the research served as a vehicle for developing knowledge and theories relevant to practices in teacher education.

Research Context and Participants

Context

The context for this research is a teacher education program. Some of the background detail pertaining to this context will be elaborated on in the next chapter. Suffice at this point to say that the practices under investigation within this program were those concerned with the integration of ICT into teaching and learning practices that were part of one elementary teacher education program at UBC. This program was known as CITE - a Community of Inquiry for Teacher Education. The core of this program was a group of 10 instructors, between 36 and 39 student teachers each year, and associated school personnel, who worked together to learn about teaching and being a teacher during this year-long program. One of the initiatives in this program was to develop uses of ICT that would augment program goals related to integration, research and communication. My

role in the program, as a teacher and researcher, was to develop some of these technology initiatives over a period of three years.

This one teacher education program and the changing technological practices over the last three years can be considered a 'case' in and of itself. In this thesis however I have chosen to report on three smaller cases or sets of practices that took place in the third year of the program. These smaller projects took place in three different courses and involved my collaborating with three instructors to develop course assignments that used the technology in ways that sought to support program goals and that linked to the three key reasons for integrating technology into teacher education programs that were outlined in the previous chapter - program integration, professional communication and alignment with technology work in schools. Each project, located in the Education Studies, Language Arts and Mathematics Education courses, represented one modest attempt to determine whether and how the technology could be used to extend the range of communicative options, and hence learning and levels of intellectual engagement in each subject area.

These three cases were chosen because they represent the most substantive technology initiatives to be developed in the program, and subsequently, they contained the broadest possible range of data relevant to the subject matter under consideration. Further, the pedagogical practices surrounding each project set up points for comparing various uses of technology and their effects in relation to student learning. The projects had developed out of cycles of research undertaken in the previous two years. Thus, while each of the projects was a new assignment and a 'first' for each of the instructors and students, there had been considerable lead up work in the previous two years that enabled this level of technology integration. This lead up and the orientation to technology that was developed will be discussed in more detail in later sections of this chapter as well as the next chapter.

Research Participants - Roles and Relationships

Any social research has its set of social politics that need to be teased out by way of explaining the methods and ethics of the research process. In this research, my intent was to establish a set of collaborative work practices with instructors and students in the CITE program in order to develop some technology projects. While some aspects of the relationships between participants will be discussed more fully in the next chapter, here I will focus on the process of establishing participative research practices, my own role as a researcher and practitioner and the ethical underpinnings of the research relationships.

I will begin by examining my own role in the CITE program as a teacher educator and researcher. In many ways I saw my self as a practitioner struggling to develop worthwhile applications of technology alongside other practitioners in the program - both instructors and student teachers. My responsibilities in the program were concerned primarily with the integration of technology into the teaching and learning practices both at a course and program level. The research which sought to investigate and evaluate these uses of technology became an integral part of my responsibilities as a teacher educator. The related teaching and research roles gave me a unique insight into what was happening. I could get my hands dirty, so to speak, in matters pertaining to the development of a technology agenda, experimenting with software, designing teaching activities, working alongside instructors, teaching students in the lab, analysing student work and so on. As a researcher I could take the time to document what was going on, reflect on the reactions and responses of people, provide on-going reports, and set the work into a larger context of technology and teacher education research.

On one level the roles complemented each other: the work I was doing as a teacher informed the research and vice versa. On another level there were various tensions across these roles. The three points that follow provide examples of these tensions. 1. The tasks and responsibilities associated with technology integration at times tended to overshadow the research responsibilities. 2. The commitment to establishing a set of workable technology practices did, on occasion, make it hard to step back from my own interest in the projects and my own will to see some degree of success. 3. Being part of a professional work community and simultaneously critiquing the practices of that

community. Kemmis and McTaggart (2000) talk about the need to develop a critical perspective by stepping 'outside' the practice and while I don't think it is possible or even necessary to step entirely outside the practice to gain a critical perspective, their point is that checks and balances need to be in place to enable a critical perspective to be brought to bear on the practices under investigation. The specifics of these checks and balances will be raised through the various sections below.

While I acknowledge that I had some role in the practice, the focus of the study is not merely on my own actions; the parts played by instructors and students in the CITE program and in the research project are of greater interest. The instructors in the CITE program were crucial to the development of all the technology initiatives. They were ultimately responsible for the teaching and learning practices in the program and for the degree to which technology was integrated into coursework. The project work described in this thesis involved working closely with three instructors. While the ways of working with each instructor differed, my intent was to make this process a negotiated and collaborative one - particularly in relation to the design of the projects, the teaching and technical support and the interpretation of data. In this respect, the instructors were not 'objects' of the study, rather co-participants. This was necessary in order to take account of instructors' interests, values and beliefs, as well as for developing projects that had relevance to course goals and that had some chance of being sustained in future years.

The 39 student teachers in the CITE program in the third year of the study were also able to participate in the project in different ways. Uses of technology were part of course requirements and so on one level, students had to participate in the projects. However I was at pains to ensure that students knew about the purpose of the research and could choose the degree to which they wished to be involved in those aspects of technology use that were specific to my research interests. Two meetings were held at the beginning of the year with all students. At these meetings I explained why technology was being integrated into coursework, the nature of my research project and the possible ways in which students could participate in the project. At these meetings consent forms were distributed to students (Appendix A). The consent forms also explained in writing the purpose of the research. Students had the following options:

- Not to participate in the research
- To participate by providing me with access to the texts that they produced as part of the technology projects and to their comments made when completing surveys and evaluations.
- To participate in focus group discussions over the course of the academic year. The focus groups would provide a sounding board for both planning and evaluating technology projects.

Of the 39 students 38 gave their consent to my use of their written texts and evaluations and surveys. Eight students agreed to participate in focus group discussions. While the demographic detail pertaining to participants' background with technology will be discussed more fully in the next chapter, at this point I think it is worth noting that among the students and instructors, and within the focus groups, there was a range of interest and expertise and degrees of access to technology. Some participants had little knowledge of and interest in ICT, while others had considerable interest and expertise. Amongst those in the focus groups all students had at least a working knowledge of a computer for word processing and internet use. Over and above this there was considerable variation in these eight students' experience and interest in technology.

Broadening the base of the research so that instructors and students could be co-participants was crucial for a number of reasons. It extended the interest in the uses of technology amongst the entire group; it provided a way of ensuring that the practices put in place and the outcomes of the research were of relevance to the participants and their context; it helped me to gain a critical perspective through discussing and testing ideas with others. The structure of the focus group meetings with students provided one example of this joint inquiry. At each focus group meeting all the participants were able to ask questions, evaluate practices and make suggestions for future action. Five of the students also joined with me to present at a teacher research conference held at UBC. As well, one instructor and I worked together to prepare papers for conferences and publication (Mitchell & Wakefield, 1999; Mitchell & Wakefield, forthcoming).

The Dynamics of Research Relationships

The dynamics in any research relationship are important to discuss because of their influence on what gets said or not said, what gets reported or not reported, and who benefits from the process. In teacher research in particular, questions can also be asked about participant (especially student) choice, degrees of exploitation through the research process and conflict of interest that may exist in the teaching and research agendas. These ethical and power issues played themselves out in different ways through my relationship with both instructors and students. At this point it is of value to note that my institutional position as a graduate student and a research assistant in the CITE program meant that I had a limited set of actual teaching responsibilities and limited institutional authority. This I think served to ensure that both students and instructors could choose to participate and work with me if they so desired. As a researcher I held little coercive power. Yet at the same time there were occasions when I found it to be difficult to initiate project work or push for change from my position as a graduate student in the CITE program. As a researcher I also held little institutional power.

It is also worth noting that the technology research was part of an agenda that was agreed to by members of the CITE instructional team. This agreement existed over and above my own involvement in the program. Yet the agreement did not require all instructors to use technology. My role became one of trying to develop the detail of this agenda in ways that were consistent with participants' interests and commitments. Any initiatives that I proposed were always negotiated with the instructional team or with individual instructors. As well many technology initiatives were developed in a way that was independent of my involvement in the program. In some of these instances instructors invited me to be part of their work or to enable my research to proceed within their own practices.

My relationship with the CITE instructors, and particularly the three instructors with whom I worked closely in the third year of the project, was collegial and collaborative. Indeed I was considered a member of the instructional team. During the course of my three years of involvement in the CITE program I had developed a close working relationship with each of these instructors. Instructors agreed to experiment with

technology as part of their teaching practice and to work with me as part of this process. While this process was a negotiated one, instructors ultimately made decisions regarding how they wanted to build the projects into their teaching practice. This helped me to stand back from the projects and observe the different ways in which participants responded to, and used the technology.

Negotiating an ethical research relationship with students in the program was also important. It is worth noting that while I had some instructional responsibilities (e.g. organising the lab sessions) and was a member of the instructional team, I was not responsible for the courses in which the technology projects were located and nor did I have the responsibility for assessing student work. In this respect I was able to keep my teaching and research role separate from matters pertaining to grades and assessment. Furthermore, no data were analysed until grades had been submitted and all surveys conducted were anonymous. I think because of this students felt more willing to talk to me about the projects because they knew that what was said about technology use would not have any bearing on their grades.

Whilst obviously I stood to gain in one way or another through the research process, one of my main concerns was to develop practices that would be beneficial to all those involved, so that at the very least, both instructors and students could have some experience with technology and make some decisions about its use and value. In this respect I did not feel as if I was exploiting the goodwill of those who participated simply for the gains that I might be accruing through the research process.

Stages of Research

Action research is typically framed as a cycle of planning, action and reflection which leads into further planning, action and reflection (Carr & Kemmis, 1986; Grundy, 1995; Kemmis & McTaggart, 2000). The detail of this will be described in the next chapter, especially as it occurred over the course of three years. In this chapter I briefly describe the cycle, and will focus in particular on the reflection phase. My reason for doing this is because I want to explain the methods for data collection and analysis that are central to

the reflection phase, as well as some of the methodological and epistemological questions arising from approaches to action research in general and my own research in particular.

Planning and Action

The experimental work undertaken in the first two years of the program, coupled the ideas concerning technology and learning discussed in Chapter Two provided the basis for developing the three projects that are the focus for this study. The conceptual work of Bruce and Levin (1997) and Kress (1998) was drawn on to cluster the uses of technology around the following three practices: communication, inquiry and design. These three concepts provided a useful framework for establishing a set of technologically mediated learning activities in each project. These activities included: using web-based resources; developing lines of communication and exchanging ideas with a wide range of people through the internet; broadening the audience for student work through the internet; and using multi-media to generate and communicate ideas. The working hypothesis was that technology, when used for these purposes, could link people and ideas in ways that could extend levels of intellectual and professional engagement across the sometimes disparate parts of teacher education programs.

The three projects described in this research were located in the Education Studies, Language Arts and Mathematics Education courses respectively. Each project was an assignment that was part of the coursework in the subject. In Education Studies students participated in an on-line discussion concerned with technology, equity and education. In the Language Arts course students contributed to on-line discussion forums that were linked to articles published in the journal *Reading Online*. In the Mathematics Education course students designed a multi-media presentation by way of explaining a mathematical concept to school children. The purpose and learning conditions to be tested in each project can be found in Table One.

Table 1: Project Outline

PROJECT	PURPOSE	LEARNING CONDITIONS
Ed Studies Online	<ul style="list-style-type: none"> • Collectively build ideas about technology, education and equity • Critique research and practice 	<ul style="list-style-type: none"> • Audience • Peer evaluation • Collective writing • Finding and drawing on relevant electronic references • Access to multiple perspectives and views of experts
Reading Online	<ul style="list-style-type: none"> • Engage in professional and public forum • Discuss relevance of research to practice of language education 	<ul style="list-style-type: none"> • Public audience and evaluation • Access to electronic resources • Writing
Hyperstudio-Math Project	<ul style="list-style-type: none"> • Explain and teach a math concept using Hyperstudio (multimedia resources) • Begin to think about ways of integrating technology into own teaching practice • Assess nature of own learning 	<ul style="list-style-type: none"> • Audience • Collaborative design • Integrating modes of communication

Data Collection

There are three main sources of data for this research. Each source provides an indicator of the ways in which, and the levels at which, students engaged in and reacted to the technology projects. The three sources also provide insight into particular pedagogical practices and the degree to which each activity fostered the goals of a community of inquiry. One source of data are the texts produced by students - the on-line discussions and multi-media presentations. The on-line discussion for example produced over 220 contributions by students and other participants. The reviews submitted to the journal *Reading Online* also need to be seen in the context of an open forum and thus are part of a larger set of responses to ideas about language and literacy in classrooms. Each of the 39 students made at least two 500 word contributions to the forums. Thirdly, 19 Hyperstudio presentations were produced, each presentation containing 10 slides. These texts constitute a large corpus of material. The language of these texts is revealing of the connections between the topic or subject area, the tenor relationship between those

involved in the interaction and the mode for communicating (Gee, 1999; Halliday & Hasan, 1989)

A second source of data are the comments and reflections provided by students and instructors. These comments were made through written surveys and evaluations, and tape-recorded focus group sessions and interviews. Following each project students completed a written evaluation of the process. While the form of evaluation varied from task to task, the main concern in each was for students to describe the processes associated with completing the task and comment on what they had learnt and what they saw as the value of the technology for mediating learning. Focus group meetings were held every month for seven months. There were two groups of four students. These meetings were unstructured in the sense that the students or I would raise topics for discussion based on our recent experiences with technology. Each meeting would typically last one hour. Group meetings were chosen because I wanted to avoid the formality of an interview and establish a structure that would enable the students to feel as if they were participants in the process. Typically the meetings would provide the participants with an opportunity to talk in more detail about the tasks and their learning than had been possible in the surveys or written evaluations. These meetings also provided me with an opportunity to sound out my own interpretations of events with students and to get their feedback on these interpretations. In the meetings we typically talked about the processes that students adopted in undertaking the technology projects, their reactions to the task and what they saw as the key parts of their own learning, the differences between these tasks and other teaching and learning activities and their reactions to my interpretations of the work they had been doing. The meetings were recorded and transcribed. Transcripts were provided to students so that they could add or change the detail of the record. To augment the evaluative material provided by students on-going discussions with instructors were held and notes were kept of these meetings. Taped interviews with two of the instructors were conducted following the project work. Again these discussions were broad ranging but gave important insight into the value that the instructors assigned to the task and to student learning through doing the task.

My own records of meetings and observational notes from classes provide a third set of data. These notes were kept from instructional team meetings, meetings with various support people, individual meetings with instructors and frequent informal conversations with students. Notes were also kept after lab and class sessions by way of recording both my own and student and instructor reactions to the tasks at hand.

The three sets of data together provide a comprehensive view of the means by which participants engaged in the project and the value they attached to the work.

Data Analysis

The analytical focus in this dissertation is on the three projects described above. As a prelude to this analysis, the next chapter describes the background to the entire set of projects and to the general use of technology in the CITE program. This provides the necessary social and institutional detail in which to locate the more specific evaluation of the three individual projects. It also provides a framework for considering the collective effects of the projects and I return to this in the final chapter of the dissertation.

The analysis of each project has three main parts. The first part provides the background to each project, explains the purpose of the assignment and the associated teaching and learning activities, and examines the links between the texts, the technological mode and the context. The second part examines what I have called the pedagogical processes central to the work undertaken by students. This involves an examination of the conditions for learning, particularly the degree to which the technology provided opportunities for students to make connections between people, ideas, resources and experiences. The third part involves an examination of the ways in which students were able to draw on these connections to extend their learning and to integrate ideas in ways relevant to their professional practice. Below I elaborate on these three parts of the project.

Part 1 of Analysis: Text, Technology and Context

This part of the analysis will provide the background to the three technology tasks - their purpose, where they fit into course goals and how they were structured as assignments.

The fact that the tasks were assignments sets an important dynamic for the analysis. Dias, Freedman, Medway and Pare (1999) provide some useful ideas when considering the purpose of university assignments, particularly those with a professional focus. They argue that assignments have an epistemic purpose. That is, the doing of an assignment serves as a mechanism for learning something about a particular subject area, for developing, articulating and justifying knowledge and ideas. An assignment also serves as a mechanism for displaying learning and knowledge to an evaluator. Here the epistemic purpose is closely tied to the grading and credentialing functions of a university. Assignments can also serve a social function. The processes of inquiry associated with assignment work can serve to apprentice students into the ways of thinking and doing within relevant professional and academic communities. Assignment work reported on in this research also served a technical function - gaining mastery of technology as a means of supporting the epistemic and social functions described above. This varied sense of purpose and function provides a useful framework for considering how assignment tasks in this study were both designed by instructors and interpreted by students. In addition it provides a starting point for considering the ways in which students negotiated the varied purposes and for considering the degree of alignment between the different purposes associated with the assignments.

In this opening part of the analysis of each project I also set the scene for understanding the particularities of the technological mode for communication and its inter-relationship with the ways in which people interact with each other and the topic under consideration. Considering the inter-relationship between the topic, the tenor of the interactions and the mode for communication draws on the ideas raised in particular by Kress (1998), Bruce (1997) and Deibert (1997). As noted in Chapter Two a central tenet of these theorists' argument is that the medium and the mode for communication play a crucial part in how meaning is represented and how social relations are structured. This provides the background for the next sections which consider the potential associated with new modes

of communication, new pedagogical roles and relations and the implications this has for understanding and developing ideas within the field of teacher education.

Part 2 of Analysis: Pedagogical Processes - Nature of Connections

In the second part of the analysis of each project I examine the electronic texts produced by students and the comments and feedback provided by students and instructors. My main purpose here is to illuminate the processes that students engaged in to produce the texts and how this related to the ways in which students represented and/or extended their understanding of the topic at hand. In the first instance I will examine the conditions for learning associated with the technology. Using the technology for the purposes of communication, inquiry and design establishes the conditions for a set of connections between people, between ideas, and between representational resources. These connections can then be examined to determine how they might support learning and intellectual engagement.

The theories on learning presented by Shulman (1999) and Wells (1999) and discussed in Chapter Two have been drawn on to provide a framework for describing and evaluating the conditions for learning. Within each project, and in slightly differing ways, the following are considered:

- The connections that students make to existing sets of resources. This includes the degree of access to information, resources and tools; the nature and type of electronic citations; the relevance of electronic resources to the task at hand and to past experience and future action; and the degree to which these resources were built upon and transformed in ways relevant to the assignment purpose and professional learning.
- The connections and relationships between people (instructors, students, experts in the field of practice and research). This includes range of opportunities for collaboration and the negotiation of ideas; the public presentation of ideas; the evaluation of ideas by others in the professional community; the degree of collective reflection and critique of ideas; and the extent to which ideas were built upon and used by those in the professional community.

Part 3 of Analysis: Substance of Connections

The second layer of connections, and the one that is crucial to intellectual engagement and professional learning in a teacher education program, concerns the degree to which the ideas emanating from the above processes and sets of connections assisted students to link, or at least hold in relief, those parts of teacher education programs that have been identified in the literature as being disconnected and fragmented. In other words it considers whether the substance of student work was indicative of connections between theory and practice, published research and experience, campus and school-based work, and perhaps more importantly, whether those ideas were enacted in meaningful ways in practice. The assumption here is that these broader connections are critical to the ways in which teaching practice can be articulated, understood and justified.

The sets of connection that provide the basis for the analysis are presented in the table below:

Table 2: The Nature and Substance of Connections

	People and Ideas	Nature of Connections	Substance of connections
Students	<ul style="list-style-type: none">• Student teachers• Instructors• Experts• Personal experience• Electronic Resources (research, practices, media)	<ul style="list-style-type: none">• Exchange, collaboration and negotiation• Public or peer assessment and evaluation of ideas• Accessing and referencing online resources• Presentation of personal experience and first person perspective.	<ul style="list-style-type: none">• Theory and practice• Across courses (foundational and applied)• Experience (past and future) and Published research• Academic and professional knowledge• Campus and practicum experiences

The intent of this process of analysis is to provide some insight into both the nature and substance of the interactions and connections that were mediated by ICT through the

project work, particularly by way of ascertaining their value in a teacher education setting.

Broad-Brush Research Questions

Having presented the framework for data collection and analysis there are still a number of recurring questions that are central to all research and the epistemological claims associated with the research. These questions are related to the standards of evidence and reasoning used for making judgements, the validity of the research findings, and the generalisability of the findings. This links to and builds on the previous discussion about my position in the research, the subjectivity of that position and the implications for the research claims. Whilst the research ultimately reflects my own subjective experience, Schon's (1991) question gets at a dilemma that I have struggled with through the entire process of the research. Schon asks, "Is it possible to recognize ... that while every description of a practice is a construction, it need not be an arbitrary one? (p. 348)."

Validity and Utility

I will discuss briefly not only Schon's response to this question but also the ways in which Carr and Kemmis and Kemmis and McTaggart deal with these issues and how their ideas have informed my own actions and interpretations. Key terms used by these theorists include 'critical reasoning', 'rational discourse', 'intersubjective agreement', 'underlying theories', and 'reflection'. Integral to the meanings of these terms developed by the respective theorists are procedures and warrants for making claims that are based on standards of reasoning and evidence and a process for testing those claims in public forums with other knowledgeable practitioners. These procedures are a social practice in and of themselves. They are shaped by the subjectivity of the participants as well as by the methods and standards of discourse and critique within the practice setting or within a research community. The process does not assume that a 'truth' can be found through the process of research but that judgements can be made in ways that are not bound by an objective/subjective dichotomy (Kemmis & McTaggart, 2000). In this research the process of selecting data and presenting evidence is aimed not so much at ascertaining the

'truth' but rather at developing a comprehensive and coherent account. The various sets of data enable the situation to be looked at from various angles.

I will consider in the first instance the ways in which Carr and Kemmis elaborate on procedures of rational discourse and intersubjective agreement:

'Objectivity' involves not a naïve belief in neutrality so much as a shared intersubjective agreement about the sorts of norms of enquiry and standards of rationality which will ensure that theories can be critically assessed without undue intervention of subjective bias and personal prejudice. In this sense scientific objectivity is not that which corresponds to some neutral reality. Rather, 'objective' reality is itself that which corresponds to the intersubjective agreement of a community of enquirers whose deliberations are conducted in accordance with shared standards of rationality. 'Objectivity', therefore, is achieved when participants reveal a willingness to make their views and preconceptions available for critical inspection and to engage in discussion and argument that is open and impartial. (1986, p.122)

In bringing these ideas to a conception of action research Carr and Kemmis argue that what makes it research is the "systematic development of knowledge in a self-critical community of practitioners" (p. 188). This requires those engaged in the research to test their claims in public forums and with others engaged in the practice. This is done in accordance with appropriate or agreed upon standards of evidence and reasoning. In this study a process of collaboration with participants enabled me to check my interpretations of the data. This took place through on-going discussions with participants and through instructors and students reading drafts of each case study.

Thus far the discussion has been concerned with the standards of reasoning that might be necessary to validate a research claim. This assumes that the claim has been open to public scrutiny, subject to rational debate and so on as part of the justification process. This is nothing new in terms of the purpose of research, which has traditionally been to articulate or generate knowledge. The issue of validity becomes slightly more complicated, however, when one considers the following statement made by Schon:

Its [the outcomes of research] ultimate warrant, the primary source of validity in the propositions produced as results, must lie not in their validity as statistical generalisations or 'covering laws', but in the extent to which practitioners who reflect-in-action in the light of them are able to use them to design effective interventions, confirm action-oriented hypotheses, or gain new insights into the phenomena of practice. (1988, p.28)

Schon's point is that educational research serves no purpose, nor is it valid, unless it usefully informs practice. This is a point echoed by Carr and Kemmis who say that the findings of educational research "will have little *educational* value if they do not enable practitioners to develop a more refined understanding of what they are doing and what they are trying to achieve" (1986, p. 118).

The validity of the research, in this respect encompasses the utility of the research. Thus research findings gain legitimacy, or are validated, through their practical or political effects. This is obviously one of the central tenets of the critical agenda set by Carr and Kemmis and the practical agenda established by Schon. It was certainly an agenda in this research project - which was to develop practical, equitable and purposeful uses of technology in a teacher education program. Hammersley, however, sounds a note of caution regarding this:

Sometimes, perhaps under the influence of pragmatism and critical theory, what were judged to be good effects, or at least good implications, were treated as evidence for the truth of the research conclusions. Alternatively, truth was downgraded as a criterion or simply rejected as a spurious issue, in favour of a concern with direct instrumental value. (1998, p.142)

Hammersley's point is that the validity of the claims is an important criterion when judging education research and should not be overshadowed by instrumental concerns. However, I do not think that Schon, Carr and Kemmis, Kemmis and McTaggart necessarily 'downgrade truth' in relation to utility. Rather, utility and validity are different sides of the same coin. In fact, the instrumentalism associated with what Schon calls technical rational research is strongly rejected. Their views assume that practice-

based research should and must inform practice. This is its purpose, it is not independent of validity, it is part of its 'truth', so to speak. Hammersley's point is, however, well taken in the context of research concerned with the educational value of technology. It is a field of research in which there are many instrumental agendas ranging from those concerned with capital gain and technical efficiency through to those concerned with critical literacy and equity. As Bryson and de Castell argue:

The divisive playing field of educational technology is populated by various teams telling altogether different "true stories" having quite different settings, characters, and plots, with very different impacts for both educational outcomes and appropriate relations. (1998c, p.82)

It is a field too, marked by inflated rhetoric about both the pitfalls and value of educational technology (Burbules & Callister, 2000b). Furthermore, in the literature concerned with technology and teacher education there are many projects in which claims are made about the value of technology without adequate justification and with little by way of theoretical analysis (Blanton et al., 1998). Perhaps what is important is clarity surrounding what counts as good evidence in relation to the purpose of technology use and of the task with which it is associated. There is often considerable obfuscation surrounding both, and the approach to research design and analysis that I have developed is, I hope, both socially and epistemologically responsible.

Specific or Generalisable Knowledge

While I have attempted to delineate the criteria used to make judgements and the theoretical underpinnings of the action and reflection, questions remain about the relevance of this work to other settings, other practices and to theories about practice. I am mindful of Atkinson's and Delamont's (Atkinson & Delamont, 1986) critique of those case studies that are merely 'one-off' accounts which bear little 'systematic relationship' to other cases and practices. One of the arguments developed by Carr and Kemmis (1986) and also by Fenstermacher (1994) is that practitioner knowledge is specific to the context in which it was developed. It is not generalisable to other contexts. While not discounting the significance of knowledge specific to one context, it does not have the breadth of purpose that could be attached to a case study - that is to illuminate,

explain and raise questions about the phenomena under consideration and to serve as a comparison to other related practices and contexts. Indeed I believe that the usefulness of the research should encompass more than the immediate context. The explanations and descriptions, if adequate, can have relevance to other contexts as a means of understanding and informing practice. In other words those outside the practice can learn from the experiences, knowledge and conclusions made by those in another practice setting.

Schon argues that the 'underlying stories', the theoretical frameworks, are the points at which the generalisability of practitioner and action research can be found.

Surely it is legitimate in a relatively brief practice to forgo critical inquiry into one's own framework, to seek truth within a frame rather than about and across frames. Yet the very diversity of stories and perspectives underlying the essays in this volume provokes a further question. Can we say that one underlying story or frame is more adequate – more pertinent, more valid – than another? Or that certain underlying stories ought to be combined in order to create fuller, more adequate accounts of practice?... These questions are closely bound up with the issue of generalisability of the findings of practice cases. (1991, p.358)

Schon is suggesting that the generalisability of case study material may be found not so much in the explication of practical knowledge. Rather the relevance of case material to other contexts may be found in the theoretical frameworks and underlying stories as they relate to both the practice itself and the methods of researching the practice. Practical knowledge is inextricably entwined with values, politics, theories, beliefs and so on. A key issue is to consider the relationship between knowledge claims and values, beliefs and assumptions. Schon characterises these values, beliefs and assumptions as the 'underlying story'.

Articulating an underlying story can be problematic, and it is here that it is possible to see strengths and weaknesses in the arguments developed by Schon, Carr, Kemmis and McTaggart. The strength of the critical tradition of action research advocated by Carr and Kemmis is that it assumes an underlying story based on principles of participation and

social justice. The underlying story presupposes particular relations of power in educational settings as well as conceiving of education as a site for emancipation. The problem, as I see it, is that these principles and politics are either very difficult to enact, or are incompatible with, the day to day working of an educational institution. Thus it is rare to see action research projects that have a coherent political agenda. On the other hand the methodologies advocated by Schon do not presuppose any particular underlying story. This leaves the research much more open and flexible. Here the problem can be that the underlying story in fact becomes taken for granted and is not open to scrutiny. The level of reflection and the resolution of problems can therefore be superficial.

Given the above discussion questions need to be asked about the theoretical threads and underlying stories that I bring to the practice and that others bring to the practice. The detail of these theories and underlying stories builds on the ideas discussed in the literature review chapter and develops through the course of undertaking the research. Thus theories of practice will be revealed through the remaining chapters. At this point however it is worth reiterating that those methodological theories that underpin the research - based on action and design - are consistent with, and indeed integral to the nature of educational practice. Moreover the particular problems under investigation - the communicative practices that are part of teacher education programs and the applications of ICT in those programs - demand the design and study of a set of experimental teaching and learning practices that address the problem area. A second and important methodological presupposition is tied to a theory of practice that assumes some inter-relationship between individual agency and social and institutional patterns and structures. Thus while there is an acknowledgement that one can never account for the full complexity of social interaction, nevertheless the research seeks to identify salient features of agency and social patterns in order to both design plans for action and understand existing and changed practices. Finally this study is based on a theory of technology. That theory sees technology as practice, its effects being inextricably tied to the context of use. What this research sets out to do is elaborate on this theory in an educational context by examining the technology in light of pedagogical practices.

Conclusion

My concern in this chapter has been to outline the methodological approach adopted in the research described in this thesis. This has included a discussion of why the research is a project based case study, as well as a consideration of the nature of data, the methods of collection and analysis and the roles and relationships adopted by those in the research. This chapter has also, more broadly, included a review of the theoretical ideas and underlying stories relevant to the research focus. The central argument that has underpinned the methodological approach thus outlined is that project-based case studies that show specific pedagogical practices associated with the use of technology and of the conditions that enabled that innovation to take place provide the detail that can help educators as they struggle with the multitude of practical and conceptual problems associated with using technology for educational purposes. It is from such cases that a rationale for technology use can be developed and it is also from such cases that one can clearly describe and evaluate the practices associated with the use of technology. This may be one way of better understanding the ways in which technology is affecting pedagogical practice, as well as showing whether the uses of technology extend learning.

CHAPTER FOUR

BACKGROUND TO THE USE OF TECHNOLOGY IN THE CITE PROGRAM

Introduction

Working toward embedding communications technology into the teaching and learning practices that have been a part of coursework in the Community of Inquiry for Teacher Education (CITE) program has been an on-going process over a period of three years.⁹ In the first instance I wish to provide a sense of the context in which the technology use within the CITE program has developed and how and why changes to practices have occurred over the last three years. Laying out the detail of the context within one particular teacher education program enables an examination of some of the people, motives, actions, tools, discourses and institutional practices that underpin both the research design and the changes to teaching and learning associated with the use of communications technology. Examining this contextual detail is consistent with the ideas discussed and arguments developed in the literature review, the key presupposition here being that technology cannot be understood in isolation from the social practice of which it is a part. As well, an understanding of the context is a necessary part of the cycle of reconnaissance and reflection central to methods of action research (Grundy, 1995). While in this thesis my analytical focus is primarily concerned with the technology practices that developed in the third year of the research project, there are numerous conditions and factors that constitute the background detail necessary to understand how and why particular technologies were used or not used, and indeed how and why particular avenues for research emerged. Thus, in this chapter my concern will be to identify those factors and conditions salient to the development and conceptualisation of

⁹ Naming this particular cohort-based teacher education program makes it very difficult to preserve the anonymity of those involved in the program. However I believe it is important to name the program because the particular principles underpinning the program are important contextual factors underpinning the research. Later in the chapter I do name certain people who have been involved in the program. I have

technology use in this one teacher education program, and more specifically, the design of the three projects that took place in the third year of the research.

Salient Features of Context

The rhetoric related to the educational value or otherwise of technology in both university and school settings has an effect on the content and process of the curriculum in teacher education programs. The research setting, a teacher education program at the University of British Columbia (UBC), is at the intersection of two related institutional agendas. UBC has various proposals regarding the integration of technology into tertiary teaching practice (University of British Columbia, 1998). Likewise the British Columbia Ministry of Education has a range of policies directed toward the use of computer technology in schools, along with the acknowledgement that it is the education of teachers that is crucial to such policies (Ramsey, 1998). Teacher education curriculum is influenced by both the call to change, and hopefully improve, teaching and learning practices that are part of university coursework and by the call to ensure that teachers have the requisite knowledge to use technology in school settings. However policy is one thing; a clear pedagogical purpose and workable set of practices is another. As a consequence there has been considerable debate within the Faculty of Education at UBC, as well as other institutions, regarding the educational value of technology and its place in teacher education programs. The experimental work described in this thesis represents one practical attempt to contribute to this debate. A key part of the research design was to develop and articulate purposeful uses for and a critical understanding of technology within teacher education.

The CITE program, which has been in operation, at the time of writing this thesis, for three years, developed in response to the problems of fragmentation associated with teacher education programs and that have been outlined in Chapter Two. A central platform within the CITE program was to create lines of communication that would support the development of a community in which student teachers and campus and

obtained their permission for this and I use their names primarily because I want to credit the contribution that these people made to the study.

school-based teacher educators could work together to investigate matters related to learning about teaching and being a teacher. The principles and practices guiding the CITE program therefore included inquiry and reflection within a community, and the development of activities that promoted the integration of and coherence between program parts (Farr Darling, 1999). The program represented one effort to define and articulate the means by which the intellectual life of a teacher education program could be stimulated and, more particularly, the ways in which the knowledge generated through academic research and professional workplace practice could be examined and understood by those engaged in teacher education. Teaching practices as well as a variety of programmatic structures were established to support the goals of community and inquiry. The practices and structures were underpinned by the ideals of collaboration and negotiation as the means of developing, justifying and articulating theories and practices related to the teachers' work and learning to teach.

The technology initiatives and the research associated with those initiatives were considered by those working in the program to be consistent with the program goals related to both community and inquiry. This said, the technology development and associated changes to teaching practice within the CITE program was a process that was slow, somewhat unpredictable and at times fraught. It has taken time to learn to use the various software programs, articulate a pedagogical purpose and build the use of the technology more systematically into teaching practices. In the first year of the program email list serves were used as a means of conveying information and ideas between and among instructors and students. In the second year more experimental work took place with the introduction of WebCT (Web Course Tool) as a platform for much of the technology use. The third year saw a more consolidated, yet still experimental, approach to technology. The detail of WebCT and some of the initial experiments will be described later in this chapter. Prior to that I will describe in detail the program, people and practices central to the development of a set of technology practices in CITE. In doing this I will attempt to weave together factors that are individual and site based with factors that are part of broader social and institutional patterns.

Program

The notion of a crowded curriculum is one that applies to teacher education programs at UBC. The degree program, 60 credits of coursework, is taken during one calendar year. Coursework in teacher education programs at UBC include 'foundations' subjects (Education Studies, Psychology and Language Learning); curriculum methods subjects (Mathematics, Language Arts, Art, Science, Social Studies, Music and Physical Education); and 'practice of teaching' subjects (Communication, Principles of Teaching and 15 weeks of Practicum). The time allocation for these subjects typically involves a full weekly schedule of face-to-face classes or work in schools. Computer technology was a 'new' inclusion into the program, and where it might fit into an already full program and an existing set of curricula practices proved to be problematic. Was 'technology' something that existed over and above other expectations or would something drop off to provide time for work in this area? Was it to be viewed as a subject area in its own right or could it be integrated into existing coursework? If it was to be integrated, how would this happen, and what time would be allocated within the coursework to learn and use the technological tools? The 'space' for the technology was therefore not immediately apparent. Moreover, whatever 'space' there was would be limited. This space was the topic of on-going negotiation between program participants, especially among the instructional team.

People, Values and Practices

The people working in the CITE program, instructors, student teachers and school teachers, are central to understanding the ways in which technology was used.¹⁰ Participants in the program had not only a range of technological experiences, but also a range of values and attitudes regarding technology and its usefulness as a communicative and pedagogical tool. There were also differences and/or inequalities in participants' access to the technology itself and to the knowledge required to use the technology. The reasons for these differences in interest, competence and access are many and varied and I will discuss some of these briefly as a way of providing some background to the design and outcomes of the research project.

Certainly, for program participants, computer applications such as word processing, email and internet were becoming an increasingly common part of their workplace practice, especially for research, professional communication and writing. Yet the role of technology as a deliberate and specific part of pedagogical practice was far from fixed. Indeed I think it would be fair to say that in the initial stages of technology development in the CITE program, there were some pockets of enthusiasm alongside a more pervasive ambivalence regarding the educational use and value of computer technology. Below, and in association with some of the literature examining the social factors surrounding the implementation of technology in educational settings, I will examine some of the factors and conditions particular to the CITE context that enabled and constrained the use of technology and that informed the design of the research projects. I will begin by examining some of the constraints and some of the concerns regarding technology.

Pedagogical Concerns

Students and instructors expressed a range of concerns about the relationship between pedagogy and technology at various times over the last three years. These concerns included: computer mediated communication is too restrictive and artificial compared to face to face interaction¹¹; access for all students is necessary before using technology as part of pedagogical practice; a lack of clarity regarding how the technology can be used purposefully as part of teaching and learning; and that the same or similar results could be achieved with other mediums, in less time and with less technical problems. These concerns are similar to those identified by Wild (1996) in his study documenting the under-use of technology in teacher education programs. The purpose and passage of this research project was tied intimately to these concerns.

Time and Institutional Priority

It is worth noting that learning to use technology takes considerable time. This is a point made in various studies of technology implementation in educational institutions and is

¹⁰ Indeed, I owe a great deal of gratitude to all program participants for the varied ways in which they engaged with technology, particularly the instructors who willingly agreed to engage in the experimental work.

accompanied by the refrain that those working in these institutions often have little time alongside their other workplace commitments (Abdal-Haqq, 1995; Bryson & de Castell, 1998b). Furthermore, while the education of teachers is now recognised as being crucial to the use of technology in schools, little attention has been paid in the teacher education literature to the types of support, time and training that teacher educators need to use the technology as part of their own teaching practices. Establishing this time and support was therefore critical to any use of technology. In the case of universities, Shields (1995) argues that it is the competing and institutionally valued priorities associated with research that render so little time available for learning to use technology. I would argue that this was a factor for many working in the CITE program. However it was not simply research priorities but also other teaching and administrative priorities and responsibilities that affected the time instructors had available to learn to use the technologies.

Degrees of Access to and Interest in Computers

As mentioned above and over the three years of the CITE program, all participants entered the program with some knowledge of computers accrued through their experiences as instructors and students or through other work related experiences. Yet there was some variation in the degrees of access to and interest in technology. It is important to note that there were changes in the degrees of access to and interest in technology amongst the students in each of the three cohorts. In each new cohort there were a greater number of students with both access to the knowledge associated with computers and an interest in their use in educational settings. This may be a result of rapid changes in the technology. The rapid increase in the general use of email over the last three years is one example. It may also be because in the third year the technology initiatives were advertised as a feature of the CITE program and 50% of students chose this program because of these initiatives. A brief examination of some of the demographics of the group may provide further insight into this variation and explain why some were more interested in and had greater opportunity to engage in the

¹¹ In reporting her own, as well as the attitudes held by a group of teachers in one school, one instructor called for 'high touch rather than high tech'.

technology initiatives than others. In this section I will talk in particular about the participants in the third year of the program.

All students in the third year of the program had access to a computer at home. There was however variation in the capabilities of the computers owned by students, the availability of internet access, the speed of that access and the access to printing facilities. Those students who talked about this variation explained it in terms of available finances. The six students without internet access at home and without printing facilities did note that while they had access to the computers in the lab, they were more limited in the ways in which they could engage with the technology than their peers who had internet access and printers at home.

A second demographic useful for explaining some aspects of the variation in levels of technological confidence and skill is gender. Bryson and de Castell (1998b) use the term 'disenfranchisement' to describe the exclusion of certain groups from the privileges associated with access to technological tools and skills. They argue that females are more likely to be amongst those who are disenfranchised. From my observations of students, those with greater degrees of confidence and skill tended to be male. For example, of the seven male student teachers in the program, five had considerable technological skills and confidence, whereas of the thirty two female students only two had the equivalent skills and confidence.¹² This provided the grounds for the design and implementation of technology initiatives that were sensitive to patterns of exclusion based on gender. My main concern here was to establish an environment in which female students felt willing to experiment and ask questions and in which there were opportunities for students to build and share their technical expertise with others. Second, the uses of technology sought to avoid the masculinised 'command and control' mentality often associated with technology (Sofia, 1998). There was a focus on linking technology to communication and learning, not on developing a large number of technical skills.

The above points provide an overview of some of the factors influencing, and in some cases constraining, people's use of and reactions to technology in the CITE program. Set

¹² Similar patterns of use existed among instructors.

alongside these factors were another set of values and practices that enabled the technology initiatives to develop. These included the institutional expectations that have been previously mentioned, research funding, access to excellent facilities and support through Education Computing Services in the Faculty of Education, and a group of people both within and outside the program with an interest in developing and/or embracing the initiatives. I will elaborate briefly on some of these points.

CITE program participants' interest in using ICT as part of their teaching and learning practices tended to stem from one or more of the following: knowledge and experience working with computers; a willingness to explore the communicative and educational potential of technology; an acknowledgement that some knowledge of technology is now an increasingly taken for granted part of the workplace practices in schools and universities as well as other areas of professional and social life; and for students, in particular, there was the very pragmatic incentive to know something about technology and its educational uses because such knowledge was seen as usefully augmenting employment prospects. As mentioned previously this degree of interest in the technology agenda grew over the three years of the project.

Support

There were a number of people, both inside and outside the immediate instructional team, who were instrumental in the design and integration of technology within the CITE program. These people provided considerable support, resources and ideas that assisted the technology initiatives. Of those in the instructional team, Ms Jane Wakefield, Dr Heather Kelleher and Dr Linda Farr Darling were prepared to take the risk of both working with the technology and with me to design the technology projects described in this study. Other instructors offered valuable support and feedback. There are many people outside the program whose expertise informed the design and implementation of the initiatives. For example, a chance meeting with Ms Carole Saundry, a technology teacher in the Richmond School District, led to the development of several ventures in which she played a major part. Carole's experience working with technology in schools also provided the program with information and ideas that were extremely helpful in developing technology connections between campus and school-based work. Another key

figure in assisting technology developments was Dr Bob Bruce, Director of Education Computing Services in the Faculty of Education at UBC. Dr Bruce acted as a technology consultant to the program and provided considerable support and advice. He also, on occasion, ran workshops and introductory sessions for various software programs that were used as part of the technology agenda. Dr John Willinsky, a member of my committee, and Ms Lisa Korteweg, a fellow graduate student, were collaborators in the design of one of the research projects, 'Ed Studies On-line'.

Research Resources

Underpinning the use of the technology in the CITE program was a link with the Telelearning National Centres of Excellence Project. This is a national research and development initiative among a group of Canadian universities related specifically to the use of communications technology as part of teaching and learning practices in various educational settings. One of the themes related to the Telelearning project is 'Educating the Educators'. The premise here is that the education of educators is crucial if technology is to be meaningfully built into pedagogical practice. The work within this theme is thus concerned with ways of educating teachers and student teachers about and with technology. As part of this theme the CITE program was loosely connected with Telelearning projects related to teacher education at Laval University, McGill University and the University of Toronto. Those working in the project did much to develop and articulate the guiding communicative and learning principles that were associated with educating the educators and that informed the technology initiatives within the CITE program. Gaalen Erickson, my advisor, was one of the Principal Researchers in this Telelearning project and his work in helping to establish and maintain the project was invaluable. Certainly, the association with the Telelearning Project helped to both support and justify action within the CITE program. At the same time however, the Telelearning Project had its own set of pro-technology rhetoric that was occasionally met with suspicion and mistrust by those working in the CITE program.

My own reading of the ways in which people responded to technology during the first three years of the program was one of contradictory pushes and pulls – an acknowledgement that something had to be done with and about technology, yet

uncertainty about what to do and skepticism regarding its effects or potential effects on practices. However, during this three-year period of experimentation a technology agenda did gain some momentum and became a more taken for granted part of the CITE program.

Part of my own teaching and research role in the team was to take account of the particularities of the CITE context by way of attempting to create conditions that would enable people to engage, in one way or another, with the technology. In particular this meant attempting to develop a set of practices in which people did not feel disenfranchised from the technology; in which they had some access to tools and skills; and in which they felt able to take some responsibility for purposeful educational developments associated with technology. While I have discussed my role within the CITE program from a methodological perspective more fully in Chapter Three, I will briefly describe here my more immediate responsibilities pertaining to technology use within the program. Perhaps the best way to describe my role was as an advocate, resource person and co-ordinator. I was able to explore and provide various options, conditions, supports and reasons for the inclusion of technology into programs, as well as addressing some of the constraints previously mentioned. This required negotiating a technology agenda with the CITE instructional team. Also for the second and third years of the program I was responsible for sessions in the computer lab and for working with instructors to design activities that would integrate technology into their teaching practice. I would certainly not call myself a technological 'whiz', rather in the terms used by Bryson and de Castell, I was something of a 'near peer' (Bryson & de Castell, 1998a): knowing enough to get by most of the time, but not being such a technical expert as to be intimidating.

It was clear too, that some students and instructors had broad areas of technological expertise that could be drawn on in the design and implementation of teaching and learning activities. Thus I sought to establish practices that encouraged sharing of ideas and skills amongst those in the program. My role also enabled me to take some responsibility for conceptualising an approach or set of approaches to the use of technology within this teacher education program. Here I was able to draw on a range of

ideas and resources gleaned from the literature, conferences, meetings with teachers and academics interested in technology, negotiations with the instructional team, experimental work in the program and so forth. The aim here was to, in the first instance, justify the experimental work taking place, and second, articulate a clear pedagogical purpose for technology use in the program. The details of this conceptualisation will be described in a later section of this chapter.

Tools, Software and Access

Use of particular technologies was heavily dependent on the availability of tools and programs. The Faculty of Education at UBC has three labs, two with IBM computers and one with Macintosh computers. These computers all had 'high-speed' internet connections as well as word processing and other software programs. These labs were open to students 24 hours per day. The uses of ICT in the CITE program were developed and aligned with the capabilities of the computers in the lab. In the second and third year of the CITE program one lab was booked for a two-hour session each week. This provided all students with access to computers that was necessary for completing coursework and it also provided an opportunity for instruction and support for using particular tools and software. It is worth noting at this stage the differences between the computers that student teachers had access to at UBC and the computers that they had access to in schools. Although changes were taking place in schools at the time that the projects were being developed, most of the practicum schools had only one or two computers with internet access. There were also considerable differences in software programs available on the school computers and the ECS computers. These differences did make it difficult to develop a technology agenda that was coherent across campus and schools.

Various uses were made of different software programs as part of the technology agenda in the third year. This use focussed especially on communication, inquiry and design. While these uses will be discussed in more detail in later chapters, it is worth noting the type of programs used because of the ways in which they shaped and reflected the approaches to technology developed in the program. The main software program used

over the last two years was WebCT (Web Course Tool).¹³ WebCT has a range of tools that enable course material to be located on a web site and that enable students and instructors to communicate with each other through the use of, for example, threaded discussion and student presentation tools. Along with its communicative potential, WebCT was also used in the CITE program because it was developed at UBC and thus there were no associated costs, and there was technical support within the faculty for this program. It is of note that one WebCT site housed all course and program information. Thus, rather than being used simply as a tool for course delivery, the WebCT site was also used as a mechanism to make coursework open to all program participants and to integrate program parts.

A key part of the use of the internet were web sites and web resources that assisted program participants to locate information relevant to theoretical and practical coursework requirements. Two web sites that were used specifically for assignment and instructional purposes were *Reading Online* and the *Public Knowledge Project* (PKP).¹⁴ *Reading Online* is an electronic journal published by the International Reading Association. The journal publishes articles concerned with language education, especially, but not exclusively, concerned with technology and literacy education. Attached to published articles are public discussion forums. Readers of the journal can contribute to these forums. The *Public Knowledge Project* has been developed in the Faculty of Education at UBC. Its purpose is to filter research, policies and practices that are concerned with technology and education. This site provided students with access to many documents related to coursework.

Web and hypermedia design programs were introduced to students and instructors as a means of communicating ideas using multi-media capabilities and hypertextual forms of writing. Netscape Composer and Hyperstudio were used for these purposes. These particular programs were chosen primarily because they were readily available, relatively easy to learn and relatively inexpensive.

¹³ WebCT was designed in the Computer Science department at UBC by Murray Goldberg. In 1999 WebCT was sold to a private American company. It is now a program used in many higher education institutions around the world.

¹⁴ *Reading On-line* is located at web address: <http://www.readingonline.org/home.html>

The First Two Years of the Technology Project

In this section I describe some of the projects that were developed in the first two years of the program. These experiments, which were successful to a greater or lesser degree, laid the groundwork for the projects developed in the third year of the program and that are the focus for analysis in this study. In the first year of the program email list serves were used mainly to distribute program information amongst instructors and students. While these email lists were not used by everyone, and the use by students was not mandated, the potential of this form of communication to enhance program flexibility, responsiveness and cross-course communication was realised. This led to an expansion of this type of communication and organisation in the second year.¹⁵

Year 2 of the project began with a commitment within the team to further the use of technology as a tool for connecting and integrating program parts and to build its use more substantively into coursework. 'Technology' was thus given a recognised place in the program as part of the Communications course. This consisted of two hours per week of lab time. The initial use of this time focussed on learning to use the WebCT Bulletin Board and Calendar primarily for exchanging information and ideas among those in the program. After an initial burst of enthusiasm, the use of WebCT tapered off. A small number of students discussed various ideas on the bulletin board, some shared web-based resources and the calendar was used inconsistently by all program participants. Other activities and workshops related to searching the web and Hyperstudio were also offered and while students found them worthwhile, they were disconnected from coursework. 'Tech' as it was dubbed by students came to be seen as a separate subject covering a range of technological matters in a rather ad hoc way. Amidst this general activity three experiments that integrated the use of technology into course requirements were established.

PKP is located at web address: <http://www.educ.ubc.ca/faculty/ctg/pkp>

¹⁵ It is worth noting that in the first year of the program only about half of the students used email regularly, and many learnt to use email and get an email account through their involvement in the CITE program. By the third year of the program all except 2 of the 39 students had email accounts before entering the CITE program and used email regularly. This I think is indicative of the rapidity with which email is becoming a more taken for granted part of communication patterns in western countries.

In the first experiment, and as part of the Language Arts course, students were required to publish three reviews of children's books on WebCT, the idea being that a database of book reviews would be a useful resource for students during the practicum. However in this assignment the demands, as well as the constraints, of the technology became an impediment to setting up a working database. This was in part because the process of preparing a document in HTML (Hypertext Mark-up Language) proved to be more difficult and to require more time and technical support than we originally thought. Further, the way that the database had been set up meant that students submitted a disk to an instructor who then uploaded the review onto WebCT. Thus students were one step removed from the publication process and so tended not to read their own published work or that of their peers. In the following year the book review idea remained but the methods of designing and posting them on WebCT changed quite significantly.

A second experiment concerned the publication of a math resource file on WebCT using the Presentation tool. This tool enables students to upload web-based assignments onto WebCT in a space that is open for public viewing. This, we thought, would get over the problems associated with students not having control of the publication process experienced in the first experiment. Again, our own unfamiliarity with the tool, designing the assignment without realising the tool's limitations and confusion over converting Word documents to HTML caused frustration and resentment toward the technology. Through this we developed a much clearer sense of how to better use the Presentation tool. The principle of publishing and posting student assignments on WebCT was one we wanted to continue, but we needed to rethink issues of student support, the software appropriate for this, and the type of material best suited to publication needed to be put in place as part of assignment requirements.

A third experiment was a structured on-line discussion that was part of the Language Arts course. In groups of nine, with contributions from teachers in practicum schools, students participated in a four-week structured on-line discussion related to the topic of curriculum integration in elementary schools. The guidelines for discussion included the following: students were to make seven postings over the four week period and the contributions

were to be 'concise', 'threaded' and 'substantive'. Students also had to write a summary of the discussion and post that onto WebCT, as well as a reflection on the process of being part of an on-line discussion.

This on-line discussion seemed to be a turning point for all sorts of reasons. The students began to see the technology as a means of communicating ideas in ways that were relevant to the goals of the program and the course. Furthermore, they were able to do this in an environment relatively free of technical problems and thus the focus was less on learning technology and more on understanding the content. The course instructor, Jane Wakefield, and I wrote a paper for presentation at the American Education Research Association Annual Conference concerned with the on-line discussion (Mitchell & Wakefield, 1999). In the paper we examined and evaluated the on-line discussion in relation to the ways that students developed a point of view on a topic, how this compared with other forms of academic work and the implications for pedagogical relations. The results of this study indicated that the on-line discussion was useful as a means of public inquiry through collective writing. The paper generated interest amongst our colleagues in the potential of the technology as well as provided a clearer picture for what was possible.

The above is an example of what Bruce (1997) calls a second level effect of technology. In other words it was an effect beyond the original intent of the technology use. It is through effects such as these that technology became embedded in, and a more taken for granted part of, the campus-based coursework. People began to adapt and use the technology for their own purposes and take more responsibility for the shape of technology initiatives. This was particularly so for the campus-based program. However the use of communications technology as a bridge between campus-based coursework and the practicum was less successful. The final two experimental proposals, which were intended to make connections between campus and school, did not come to fruition. The aim of the first proposal was to provide a medium for student teachers to collaboratively reflect on their practicum experience and share ideas across school sites. Although the proposal was accepted by the instructional team, it was not adequately structured into the practicum curriculum to enable the project to be implemented. The second proposal

aimed to establish school-based technology projects in which teachers and student teachers would work together to develop the project. Again this proposal presupposed a restructuring of the practicum experience as well as time and commitment from teachers, student teachers and university instructors, and a certain level of technological infrastructure in the schools. Again the groundwork for this project could not be put in place and thus it was aborted.

A Conceptual Framework for Technology

By the third year of the program a sense of the pragmatics, purpose and preconditions for ICT use had to a large extent been articulated and acknowledged. Based on this, a conception of technology use within the CITE program was developed. The following three points provided a framework for this conception:

- Technology linked to program goals. The focus for technology use in the CITE program had always been concerned with communication, but this became more refined through the experimental work and through developing a better understanding of the capabilities of various software programs. As such, technology use clustered within three broad and overlapping categories – communication, inquiry and design (Bruce & Levin, 1997; Kress, 1998). More specific applications of these uses included integrating program parts, connecting people across different educational sites, providing a public space for investigating ideas, exploring and linking web resources, using multi-media to represent ideas, presenting ideas to a wide audience, and perhaps most importantly, providing participants with a sense of agency as designers and not simply receivers of the technology and the social and linguistic resources associated with the use of technology (Kress, 1998). These uses both aligned with existing program goals and provided opportunities for extending learning within and across courses.

An important part of the focus on communication, inquiry and design was the integration of technology into coursework and program requirements. In other words the use of technology was not tied to any one particular subject area, but had potential as a medium and tool in all subject areas. Obviously the differences between subjects

led to variation in how the technology was used. Such a focus is also an explicit rejection of technology use that focuses simply on 'bells and whistles'.

- Inclusive practices for technology use. Attention here was given to technical support for program participants, the provision of equitable access to tools and skills, maintenance of a reasonable scale of technology use, and the adoption of tools and software that have utility and ubiquity within educational settings, that are not alienating or intimidating and that are oriented to the needs and interests of program participants.
- Critical awareness and reflection. Subjecting technology uses to critical examination became important by way of understanding its educational value. Bruce (1999) argues that:

Techniques are important, but beyond any set of techniques, teachers need to develop critical awareness. They are faced again and again with immediate, practical situations in which they have to decide whether to use a particular technology, and if so, how, and with whom... They remind us that teachers must develop their own pedagogical philosophy – to think primarily about learning and secondarily about the technologies that support it. (p. 227)

This required, too, a move away from what Burbules and Callister (2000b) describe as the “false choices of rejectionism or boosterism” (p. 15). They suggest that discussions of technology in education are more complex than simply engaging in all or nothing debates, or weighing the good against the bad effects. Rather the effects associated with using technology can be both good and bad. Teasing out this complexity, documenting the multiple effects became an important concern for the research and drawing on that to inform theories of educational technology became an important concern for the research.

In light of the conceptual framework the following uses of technology were built into the CITE program and courses in the third year:

- WebCT bulletin board and calendar for program-wide integration
- Webpage design
- On-line discussions
- Electronic journals and resources

- Multi-media design (Hyperstudio)
- Information literacy
- CD-ROM reviews.

Conclusion

The ideas discussed in this chapter provide the framework for understanding how and why technology was used in the program and the background for the development of the technology projects implemented in the third year of the program and analysed in this thesis. I have described the context and background to the projects in detail by way of emphasising that a range of complex social and technological factors have affected and will continue to affect the course of technology use in the CITE program. The design of the research, the outcomes of the technology initiatives, and indeed the comments that I make by way of analysis, can only be understood in light of the social and technological context that I have attempted to document.

CHAPTER FIVE

EDUCATION STUDIES ON-LINE

Introduction

The aim of the Education Studies On-line project was to examine whether and how an on-line discussion could be used to create a forum for public inquiry in which students could extend their understanding of the equity issues associated with the use of technology in schools. The key learning conditions underpinning the project were collaborative writing, access to web resources and external participants. The key arguments developed in this chapter are that the on-line discussion enabled students to make a wide array of connections between their peers, external participants in the discussion, web-based research and personal experiences. In so doing they collectively developed a set of critical opinions related to the use of technology in schools. The external participants added a distinctive and valuable set of contributions to the discussions. In some cases the topic, the research resources and students' experiences in schools complemented each other in ways that enabled students to integrate the ideas raised on campus and in the research with their experiences in schools. Key problems and questions for the pedagogy associated with this activity concerned the nature and use of on-line resources and the relationship between such an activity and face-to-face discussion and more formal essay writing.

Context, Text and Technology

'Ed. Studies On-line' was, as the name suggests, part of the Education Studies course. This course is concerned with the ethics of social relations in educational settings. One particular focus is educational opportunity in relation to, for example, social class, gender, poverty, ethnicity and sexuality. The purpose of the 'ed studies on-line' task was to provide a forum for students to consider the ways in which access to and uses of

computer technology in schools intersected with social background and types of educational opportunity. Students were set the following task:

As a beginning teacher what do you think are some crucial equity issues pertaining to technology and education and what action do you think schools and teachers can take in relation to these issues?

In part the task was for students to bring a critical perspective, as well as a sense of practical action, to an educational problem that is characterised by rhetoric extolling either the virtues or the vices of ICT. The method for conducting this investigation was through a structured on-line discussion using the WebCT discussion tool. This tool enables participants to engage in a threaded discussion in writing.

Yet “why do it on-line when you can talk to the person next to you?” was a nagging question that required some attention by way of justifying our own practice and explaining to students the purpose of the activity.¹⁶ A trial on-line discussion had been conducted in the previous year in the Language Arts course. Student commentary on this trial had thrown considerable light onto the above question. Two comments were particularly influential:

Throughout my academic career the writing process has been a solitary experience. The ideas may be generated through a discussion with a group of people but the writing itself has always been left as mine to complete without much guidance... Computer mediated writing does not mean that I cannot have thought out my ideas or that I am not able to support my hypothesis, but it does allow for immediate feedback on those ideas from a variety of sources. This is peer editing before the final product has even been produced... Computer mediated writing allows students to be in the process of writing and getting feedback on the process rather than the end product, when one or two comments from a teacher may not cause the writer to rethink his or her hypothesis.

My previous experiences with academic writing have been very individualistic and very little collaboration was encouraged... It was published works that we used which mattered... Computer mediated writing promotes active research that occurs as one is writing on the screen. I feel that this type of writing makes me more open-minded.

Judging from these students’ comments, the process of writing on-line was both generative and collective. The point of comparison was not so much face-to-face

¹⁶ Linda Farr Darling was the instructor in this course.

discussion but other forms of academic writing such as essays. In this respect the on-line discussion provided a mechanism for students to conceptualise writing as an explicit part of a research process and as a collaborative activity. This seemed to provide some justification for further experimentation with the use of an on-line discussion.

However, the degree to which students drew on ideas beyond the experiences of the group was posed as an issue by one of the students in this first experiment with an on-line discussion:

We were not compiling data in the library, researching previously published literature to support what we were saying. We were supporting our statements with our own experience, but not with 'expert' endorsement.

This comment raised questions about the ways in which students justified their ideas and the degree to which published research might inform those ideas. This feedback from the previous year led us to consider how students could draw on ideas and resources from outside their immediate group, without taking away from the ideas generated within the group. To address the concern the Education Studies instructor and I decided to consider whether and how we could use some of the vast amounts of information and resources available on the web. For this reason we developed an alliance with Lisa Korteweg, John Willinsky and the Public Knowledge Project (PKP).¹⁷ The PKP web site contains links to a variety of resources (research, policies and practices) related to technology and education. Discussions were held with Lisa and John to consider how PKP could be used and to design an assignment task that took account of the resources located on the PKP web site.

The intent to use web resources was complemented by the ability to create automatic 'hotlinks' through the WebCT discussion tool. Contributors to the discussion could simply create direct links to material they referenced and readers could easily connect to

¹⁷ The Public Knowledge Project has been developed within the Faculty of Education at UBC by Dr John Willinsky. Lisa Korteweg, a graduate student at UBC, has played a substantial role in the creation of PKP. A central goal of the project is to create web sites which both bring together and filter web-based research, policy and practices. In so doing such sites aim to connect often disparate work in educational areas, as well as render the material accessible to the public. I also wish to acknowledge the assistance and advice that John and Lisa offered in designing the assignment and to thank Lisa for contributing to the discussion.

referenced web sites. This created the potential for the discussions to be hypertextual in form.¹⁸ This became a distinctive feature of the on-line discussions.

To also broaden the focus for discussion beyond the student body, interested parties from outside the CITE program were invited to participate in the discussion. This had been done in an ad hoc way the previous year. This year it was done in a more systematic way with seven people - a school teacher, a district administrator, three academics from outside Vancouver and two UBC graduate students - agreeing to participate in the discussion. These were people that I knew had an interest in one or more of the following: WebCT, technology and education, and pre-service teacher education.

In the Education Studies course the use of this on-line discussion was a change from the methods for student inquiry that had previously been adopted. Lectures, set readings, groups discussions and a term paper were, and remained, the key approaches to learning in this course. What the on-line experiment represented was one activity designed to complement existing practices and extend the level of inquiry within the course. Three tools for inquiry - writing, resource material and public discussion - could be brought to the problem setting through an electronic medium. Moreover, for both the instructor and for the vast majority of students, participating in an on-line discussion was a relatively new experience, especially as part of the teaching and learning activities within a course.

Practicalities

The actual task was designed as a type of 'webquest'.¹⁹ The task itself was presented in a web-based format that was located on WebCT. Its hypertextual nature served as a model for ways of finding, evaluating, and referencing on-line material. Thus there were links in the assignment to material relevant to the topic at hand, that modeled how these resources could be used, and that helped to frame the parameters of the discussion. In addition, links were created to sites that contained useful information for conducting web-based

¹⁸ Hypertext is a term used to describe the non-linear, rhizomatic and linked nature of much web-based material (Burbules & Callister, 2000b; Snyder, 1998).

¹⁹ Webquest is a term used to describe class activities in which students conduct research using web-based resources. The intent was that this might serve as a model for the work that students would undertake in schools.

research. Finally, the task contained a direct link to the PKP site and to the discussion forums on WebCT.

Seven discussion forums were created on WebCT. Each forum had six students and one external participant. This size group was chosen because it was broad enough to generate ideas, yet manageable in terms of the time needed to read and respond to other contributions. Each forum was however 'public' to those with access to the WebCT site and students were encouraged to read and contribute to other forums if they so wished. Students were required to make a minimum of three contributions. The first two were over a two-week period. The final contribution was made after a three-week practicum experience. The guidelines for contributions were that students be succinct and address the topic; draw on web-based resources, if appropriate, to support and provide evidence for ideas; and build on and respond to the ideas of others.

Each group was able to choose a specific focus for discussion after the introduction to PKP. Some groups chose their topic in light of the organisation of material on PKP. Other groups chose more general topics based on their interests. Some groups remained focussed on questions pertaining to equitable use of technology; other groups expanded the focus to include a broad range of social and ethical issues related to the provision and use of computers in schools. Various themes and issues emerged in these discussions. Across the forums the following topics/themes were considered: gender equity and technology; social class and technology inequities; funding for computers in schools, especially the ethics of private funding; teacher education and technology and the way that this affects educational opportunities for students; and finally the moral dimension of children's access to the internet.

It is worth noting that time was at a premium. We had only one hour in which to introduce students to the assignment and the PKP website. Moreover, there was other Education Studies coursework still to be covered which meant that there was little time to link the on-line discussion with face-to-face classes. Further the task was set for the last couple of weeks of the term and so came at a time when students were pressed with a number of other assignment requirements. As we introduced the task I became aware of

some degree of negativity - 'Oh not another assignment' and 'Why write when we can talk to one another?' Yet despite the initial ambivalence, the group as a whole were prepared to engage with the topic and with the technology and there were certainly some students who contributed responses that were over and above expectations and surpassed the desire to simply get a grade for the assignment.

Tools and Text

One of the ideas developed in Chapter Two concerned the inter-relationship between types of communication, the construction of meaning and the tools available for communicating. I will briefly relate these ideas to this particular online setting by examining the relationship between the activity - the on-line inquiry and the production of a written text - and the available technology - a WebCT discussion tool.

One key feature of the WebCT discussion tool, and other internet based forms of communication (email list serves, chat lines and news groups), is the possibility for 'many to many' (Levinson, 1997) interaction in a way that transcends time and place. The discussion tool enables participants to engage in a written conversation by linking or threading onto other contributions. Moreover, links to other web documents can be created within individual contributions. Therefore an on-line text can have multiple authors. This makes it very different from the usual written assignments that students do as part of university coursework, which typically have one author and an audience of one (the instructor). The WebCT discussion tool only threads contributions in a linear manner. Thus in order to be part of a thread it is only possible to link to one other contribution.

The particular genre that students were working in was a hybrid of sorts. It was a discussion in an academic context and so contained those actions and expectations common to academic practice - citations, lines of arguments, development of points of view, public expression of ideas (Giltrow, 1998). Along with this was an informal style of communicating that is associated with much email and chat room writing (Cherny, 1999; Moran & Hawisher, 1998), or small group discussions in class. So for example, all contributions were written from a first person perspective, many without the stylistic and

grammatical formalities associated with academic essays.²⁰ In a sense the on-line discussion was something in between face-to-face discussion and a formal essay.

Thus far I have detailed the ways in which the technology enabled certain forms of communication. Key learning conditions associated with this form of communication were the collaborative writing and the access to resources on the web. In the remaining sections of this chapter I will examine in detail the implications that this had for pedagogical relations and the processes of inquiry associated with the Education Studies task.

The Nature of Connections - People, Ideas, Resources and Experiences

Drawing on the analytical framework outlined in the methodology chapter, my intent in this section is to identify the nature and substance of the connections that students were able to make through the discussion. In the first instance this will involve a brief review of the nature and type of contributions and interactions between participants (students, experts and instructors) and the ways in which they used electronic resources. In order to do this the analysis will focus on the written texts produced by students through the discussion and will be supported by their evaluative comments made through a survey conducted at the end of the activity and the focus group discussions.

Student - Student Interaction

A noticeable feature of the on-line discussion is the way that students built on and developed their classmates' ideas. Building on each other's ideas was, of course, part of the assignment requirement, and it is an implicit part of any conversation. Nonetheless it is of value to make explicit the ways that the students did this. In noting the types of contributions it is possible to see how students took responsibility for initiating topics, developing ideas and evaluating the contributions of others. In so doing they took on a particular set of pedagogical responsibilities. Examples of these pedagogical contributions have been grouped using the following headings: asking questions;

²⁰ Most of the students in the focus groups mentioned that they typically wrote essays from a third person perspective.

outlining a position for others to react to; clarifying and building on other's ideas; and providing additional resources. Below are some examples of the types of contributions:

Asking and responding to questions

How does this translate in elementary schools where some kids have a distinct advantage over others simply because they have a computer at home?

Do you feel that these web sites are just perpetuating gender stereotypes or are they valuable for getting girls "hooked" on the net?

Questions served various functions - rhetorical, seeking a response to a comment or opening up an area for discussion and maintaining the discussion. In the above examples the questions provided a particular focus for the discussion. In the first case the question linked the discussion to a school context and asked about the specific effects that differential access to technology may have for students. Such a question requires an empirical response; it requires finding out what is happening in schools. The second question opened up an area for debate by pointing to two opposing interpretations of web-sites designed for girls. The questions in these cases had a dual pedagogical function. They encouraged other participants to think about a topic and the responses may clarify the questioner's ideas. It is worth noting however, that not all questions received a response and so while the pedagogical intent may be there, it may not always be achieved. The obligation to respond to questions that exist in face-to-face settings is not apparent in on-line discussions.

Outlining a position for others to react to, critiquing ideas:

In response to the issues that Lisa raises in her comments on the Grizzlies'²¹ environmental ed program. I was working for the Green team when the B.C. Ministry of Environment was in negotiations to create a Grizzlies environmental ed team and we discussed the pros and cons of working for and with the Grizzlies....In my mind, corporate sponsorship cannot exist in blatant opposition to an educational system that it funds. What is the point of an environmentally unsustainable company funding an environmental education program? Should we use the word hypocrisy here?

²¹ The Grizzlies are a Vancouver based National Basketball League team.

In the above example the student extended a comment raised by one of the external participants and also drew on her own experience working in the BC Ministry of Education to present her own view on the link, or more specifically, the contradictions between corporate sponsorship and public education. This student's point of view is stated categorically and the questions at the end serve the rhetorical purpose of suggesting that the sponsorship is hypocritical. Her comments were also an implicit critique of the ideas raised by some of her fellow classmates who had posted the Grizzlies' web site because of its educational value.

Making connections to and referencing other student's work in developing and clarifying ideas:

That is a good way of describing the muddy waters we are wallowing in right now, Mark. I feel very strongly about keeping business from influencing the thoughts and decisions of children... After reading Adam's hotlink about ZapMe! Where companies freely advertise on school computers, I am feeling quite negative about them. This brings me to David's point about turning the problem into a teachable moment... Jen's contribution about computers for schools is encouraging for me, because it seems to be a way to get computers for schools without allowing the tentacles of big business much access to the minds of children.

The excerpt above shows how one student made links between the comments raised by four peers in order to formulate a position on business sponsorship of computers in schools. In this respect her comment helped to draw some threads between the contributions. Again this served a pedagogical function both for the student as well as for other readers by making explicit the ways in which her point of view developed through a consideration of others' ideas.

Providing additional resources:

Just out of curiosity I did a quick search on Yahoo and came up with an entire category of websites just for girls:
http://www.yahooligans.com/Arts_and_Entertainment/Girls_Sites/
I didn't have time to check many but it would be interesting to find out what the tone of them is.

In the example above the student conducted a search of web sites related to the discussion topic and posted a web address that may have relevance to the discussion. Again this had

a pedagogical effect, as the student provided other participants with resources that could aid the progress of the discussion. Further issues related to the use of web resources will be examined in more detail later.

External Participants - Participation and Interaction with Students

The interaction between students and the external participants varied from group to group. The external participants brought to the discussions a range of interests, expertise and styles of contributing. This included asking questions, responding to questions, posing challenges, suggesting readings and other avenues for investigation, or providing their own or alternative and sometimes provocative points of view. Some contributors responded frequently, others provided one or two lengthy responses and one external was not able to contribute at all. Below are some examples of contributions made by external participants that demonstrate the particular pedagogical role they assumed.

Most externals constituted their role as one of asking questions or responding to student comments in ways that challenged the scope of the discussion or clarified ideas. Below are two examples of comments that sought to clarify ideas:

First, I think it is important to identify what the "equity" issue is here. Is it that only the more advantaged schools will get access to these corporate 'partnerships' since the potential payback to the companies will be greater? Or is it the whole principle of mixing business with education?

In the above example the external participant assumed a teaching role by asking for clarification on issues and by trying to bring focus to the discussion. Defining terms was seen as one key starting point for this focus. Certainly many of the discussions did start off in a very general way and these sorts of comments proved useful by way of establishing the terms and parameters of the discussion. In the comment below the external participant provided a summary point by naming the issues that had been discussed and in so doing provided a framework for new contributions.

From reading the entries by all those wonderful students it seems to me that we have a couple of issues: financing the equitable access to technology; teacher development and critical literacy skills in our students. The debate that is being developed is just fantastic...

The external contributors' ideas also served as a resource that could extend the discussion. These ideas included links to related web-sites, clearly articulated points of view, connections between ideas. In the example below, Lisa the external contributor, linked the topic in her forum with the ideas raised in one of the other forums. She suggested that students 'check out' a web site and report back with their thoughts. Her response provided a model for making connections to other discussions and was certainly a catalyst for further discussion.

In speaking about big business involvement with schools, I was struck by an example right here in the CITE forums. I noticed one group excitedly discussing the Grizzlies' Environmental education curriculum for classrooms. I went to the Grizzlies site to check it out. Go take a look at it INCITE people and tell me what you think.

Some of the external participants also expressed strongly held beliefs or were provocative. Below is an example.

In my experience, I think teachers should take advantage of a Big Business' interests in schools. But to do so requires a lot of critical inquiry and research by teachers that they do not have the time, energy or institutional support to conduct.

Thus the external contributors were not simply mediators of the discussion, but knowledgeable participants with a perspective on the matters at hand.

The ways in which students interacted with the external participants varied. In some forums the interaction was informal and personal. In other forums the interaction was more formal. There may be various reasons for this but the important point is that the contributions made by the external participants attracted a degree of interest from the students. The expert status held by the external participants added credibility and weight to the discussion and attracted responses from students. As well they held status as readers and evaluators of student writing.

It is worth noting that in one forum the nature of interaction between the external participant and the students was significantly different from other forums. The distinctive feature of the interaction in this forum was the number of questions that students asked of the external contributor. In no other forum were substantive questions asked of the

external participants. This form of question and answer took place in the topic concerned with gender and technology. Carole, the external participant was a school teacher with expertise in technology. Below is one example of a set of questions that one student asked of Carole.

Carole, I am also interested in hearing about the specific changes you made to your teaching style and the selection of models and mentors you made in your classroom. Also who did you allow access to in the computer lab at lunch and recess? Did you permit those students who showed initiative and productive working habits, or did you allow access to those who did not have computers at home? What were your strategies because as a pre-service teacher, I am not all that confident I would recognise the power imbalance you are talking about.

The nature of this particular interaction will be discussed more fully later in this chapter. However, it is worth noting at this point that the questions were concerned with classroom practice and Carole was the only external participant who was working in an elementary school. Her first hand and day-to-day experience in a school gave the students an immediate starting point for asking practical questions. Further, the topic was one that students had first hand experience of through their own school and practicum experience, so they could immediately relate the theoretical and practical ideas to their own experiences.

Student Commentary on the Social Interaction

There was a range of ways in which students responded to the public and collective nature of the online activity. Many students found the process of collective writing to be useful, and one that extended the ways in which they thought about ideas. The following are some examples of student commentary on this:

The more we talked on-line, the more extensions ideas came to mind.

I thought individually our response wasn't as in depth as it possibly could have been, but I think collectively we really examined certain issues.

They [peers] often propelled me further and gave me ideas I wouldn't otherwise have thought about.

Promotes critical thinking - you have to read and analyse what someone has written and respond differently than we are used to doing.

Most of the student comments echoed the above sentiments, the key theme being that the collective and collaborative consideration of an idea in writing added depth to the discussion. However, not all students had such favourable response to the discussion. A smaller number found this type of interaction to be less than useful for the following reasons:

Ours was 'itsy bitsy'. We had two people that did not respond until after Christmas and so we had three trying to post, but you couldn't get a flow going.

Many of the responses were extremely verbose and as a result very difficult and time-consuming to get through.

Both comments are based on certain assumptions and expectations about contributions to on-line discussions - the discussion depends in part on some level of participation and in part on a certain length of contribution. These criticisms I think are valid in this context, but they are also pertinent to many social settings. A further criticism was directed toward the mode for communication:

I would rather have talked about the issues in person with classmates - kind of odd to write to people who are sitting next to you. What does that say about community?

This is a not uncommon criticism leveled at on-line educational practices. While I agree the practice of writing to people who are in close proximity does seem somewhat strange and it certainly lacks some of the immediacy and emotion of face-to-face interaction, I wonder if this sense is simply because the practice is not one that is taken for granted. Spending hours writing an essay to be read by only one instructor could be considered strange and is often very isolating, yet it is an accepted and often unquestioned part of educational practice in universities. The question raised in the above student comment about community, seems to rest on an assumption that some sort of face-to-face interaction is a necessary condition for an educational community, or that on-line communication takes away from a sense of community in an educational setting. While I will not directly discuss this assumption, it does raise for me some questions about the need to make explicit the part that writing plays or can play in an educational or professional community and more particularly a community of inquiry. I return to this in the final chapter.

While not all external participants were able to engage in the discussion in a sustained way, most students found their input valuable. Indeed, the group that did not have an external participant struggled to get their discussion going and one reason that I would suggest for this is because they did not have an outside person extending the debate. The three comments made by students below serve to exemplify the value they attached to the externals' contributions - clarifying and getting to the core of matters, broadening the perspective and scope of the inquiry, and bringing expert knowledge to the discussion.

We would write a response and they [the external] would go right to the heart of your response and pull out the thing that was most meaty and of the most value and ask you to comment on that.

The guest participants added unique and valuable perspectives from their own experiences. This broadened the scope of our on-line discussion and made us realise that we are part of a broad (very broad) community of educators, thinkers, shapers and learners.

Our person was Carole and she knew so much about the topic we chose. So it was incredible, she had such practical information and feedback that was immediate.

One of the features of these connections between people is the fact that it creates a public audience for student writing. This is also important for inquiry. The on-line discussion was a mechanism for providing feedback on others' ideas and receiving on-going feedback on one's own writing. Knowing that ideas would be read by others influenced the ways in which people made their contributions.

I was very careful about what was written because of the knowledge that our input is going to a public forum.

I tried to make sure that what I wrote was well thought out and well worded. I think more than I necessarily would otherwise because of the expert in the group. I was very aware that there was this person in the group that would be looking at what I wrote. I just felt they would be evaluating it in some ways so I tried to make it - make sure my grammar was correct that sort of thing.

In this next comment the student's understanding of the process of evaluation is very much connected to the fact that the discussion was in writing and that outsiders were participating.

It helped us to think about professionalism too. Just in our classroom when we are enclosed I can say anything and shoot off about anything and I am comfortable with the judgement that the class will put upon me. I also have the chance to see other people's responses and to change what I am saying. But on paper and with

other people reading, it is quite a commitment and you have to be careful to word things professionally and not just make a joke or stab.

For these students the act of writing in public meant that they were careful about what they wrote. While this could be said to stifle spontaneity, it also required students to take responsibility for what they said in a public forum.

For some students, however, the public audience proved to be utterly constraining:

The reason I have never participated in on-line discussion is because I don't like people I do not know reading my opinion and thoughts. I felt it to be a bit of an infringement to have people read what we wrote when our names appeared.

I was terrified to put my thoughts on-line for fear that I would be criticised or not understood. Once I finally did I realised that it wasn't so horrible and I wished I had started participating sooner.

The students who made these comments clearly felt some vulnerability in putting their thoughts in writing for others to view. While I empathise with them, as I have struggled on occasion to put something in writing in a public electronic forum, I also think that such public writing is an important part of an inquiry process. It provides the opportunity to test ideas with those who also have an interest and knowledge in the area. This is crucial to the justification process. The fact that ideas are in writing tends to formalise and lend weight to the process.

Connections Between Students and Instructor/Researcher

In this on-line discussion, Linda the instructor chose not to directly participate. As she pointed out, the dilemma in any form of instruction is knowing the 'proper role of intervention on the part of the teacher', in other words balancing 'student autonomy' with 'teaching goals'. Her concern was that often the instructor becomes the focal point for discussion. To avoid this and also to give recognition to the contributions from the externals, Linda took on an observational role. The assessment of student work in this activity was based on participation rates established in the evaluative criteria and not on the content of student contributions.

For my own role, I decided not to take too active a part in the discussion, even though at times I was tempted to. My reason for this was because I wanted to be able to see how the discussions worked without it appearing as if I was prodding the whole thing along and trying to develop particular threads of discussion. I did however, participate occasionally. These occasions included responding to procedural questions from students, contributing a resource that I knew would have relevance to the discussion, and raising issues in the forum in which the external participant was not able to contribute. Thus I saw my role as maintaining the structures that would enable the discussions to continue.

Connections to Resources

The use of electronic resources was a distinctive feature of this discussion. In this section I will consider the ways in which students and the external participants used electronic material, especially PKP. The vast amounts of material that can now be found on the web pose a number of challenges for, and have instituted a number of changes to, research and teaching practices. This is in terms of not just questions of access to information, but also the means of searching for material on the web, critically reading the material, and using it to inform a discussion or argument. It is important to note that there was an expectation that students would draw on web-based resources to inform or support their ideas. The assumption underpinning this expectation is central to general principles of research - locating ideas in an existing body of knowledge and collecting evidence that can support particular claims. The PKP web site housed both research documents related to technology and education as well as policy documents, newspaper articles, examples of projects and so forth. Thus students could consider both existing research in an area as well as primary documents related to their discussion topics.

The table below provides a breakdown of the ways that participants used the web-based resources. It is of note that these have been ascertained only from the on-line discussion. It is likely that uses were made of web resources that were not explicitly mentioned in the contributions.

Table 3: Web Citations

Type of Citations	Examples	No. of Citations or Mentions
Web-site citations with commentary to inform/support ideas	An article in the PKP site, Teachers take on Technology (http://www.educ.ubc.ca/faculty/ctg/pkp/sun/24041999b.html), says that there has been a frantic effort to get computers into the hands of students, but the reasons are often vague. It concludes that students need to familiarise themselves with computers so that they can understand what this technology is and what some of its applications might be in their lives. But that to me seems to be backwards.	43
Links to web-sites as a suggestion for reading or starting point for an idea	Can we really opt out of a big business offer? What about parental pressure? Societal pressure to use computers? Here is a comprehensive website on this issue: http://www.cepan.ca	25
Response to a web-link provided by another participant	I'm off to check out the links you all mentioned	8

What the above table and examples show is that students created direct links to the material they referenced. Readers could and in some cases did link to these sites. What is also of note is that students used sites without necessarily structuring an argument around the citation. The sites in this respect were not simply drawn on to back-up points of view but also to open up the discussion.

Participant Commentary on Using Web-based Resources and the PKP

The reactions of students to using web-based resources as a tool for the inquiry varied considerably. Students were asked in a written survey and in focus group discussions to describe how they used PKP and what value they attached to it as a resource for contributing to the on-line inquiry. The table below shows the range of responses with examples of student comments. The numbers of student comments in each category are also indicative of the frequency of response amongst the group.

Table 4: Participant Evaluation of PKP and Other Web Resources

PKP informed or supported ideas	<ul style="list-style-type: none"> • The PKP gave me ideas about issues from which I formulated my own opinion to post on-line. • It just kind of backed things up and I think it helped me formulate my argument too. Like I wasn't exactly sure how I would feel on some things and then when I did research I found things that I could connect with and then added that into my argument. • I would go and try and find something and then I would try and talk about that article so that I could include it in what I was talking about, so what was available was shaping rather than backing up. • For me, before I formulated an opinion or idea I went to PKP and read the stuff that was there and then I would pick out a point that I was interested in talking about and then use PKP to back it up. • I would go to PKP first and from there I went out and did general searches on the internet for the area I was wanting to discuss and then I would go and try and find other resources to back it up. • PKP gave a good summary of readings/topics through which we could browse and eventually expand on these ideas over the internet.
Used citations because it was a requirement	<ul style="list-style-type: none"> • I think people just found things on the web for the sake of it, because it was supposed to be there. I did at least. • I didn't like the idea of using links to support my arguments. I felt it was very forced to look for supporting info. I would rather have had the discussion based on personal experiences only.
PKP had little relevance to the task at hand	<ul style="list-style-type: none"> • Some articles were interesting but I didn't find I could use them for my responses. • Found no quote that expressed my views too clearly. • I did not personally find anything that I could quote in support of my views
Breadth and diversity of web resources	<ul style="list-style-type: none"> • I was able to bring in a diverse range of resources from both educational and non-educational sources. • The knowledge repository provided a great deal of extremely useful background information that related directly to the topics we addressed. This repository provided excellent links to other sites and references to other materials. • It was handy to be able to click onto the web-sites that others had referenced.
Questions about reliability	<ul style="list-style-type: none"> • I don't know how to explain it - the book in the library has maybe more worth than some things you find on the internet. There is some guarantee to quality information. • I was never sure of the validity of the information I was reading. It's not like reading work from a journal. • I thought it was a site that we were getting reliable information. Are you telling me that the information is not reliable?
Immediacy of access to information	<ul style="list-style-type: none"> • We were able to read an article about our topic instantly. • It is an interesting way to reference isn't it? Because a reference in a paper is not so immediate, but a reference in that kind of discussion, you can go click and right away you are at the information you want.
Comments about filtering	<ul style="list-style-type: none"> • I think that is the value of PKP - those people [in PKP] had done that preliminary work. If I were to use internet resources in a paper I would a million times rather go to the site like PKP than to just do a general search. • If you have a tool like the knowledge program - it made it easier to research situations, like specific information for education. I still don't think I would search random topics, I've tried and you don't ever get what you are looking for. • Useful but needed lots of time to filter what was relevant and what was irrelevant. • The PKP site filters out pretty well everything except pro-technology articles. • I found the PKP useful as a jumping off point for an argument, but the articles didn't seem to go very in depth and they were generally of a pro-technology slant.

While some students found the PKP and other web-based resources to be of little use, or used them simply because it was a requirement, many students did find information that they could use to develop ideas or support existing ideas. In cases where the topic linked to the available resources it is clear that students could draw on a range of material to both inform and support their ideas. Some features of the site were seen as both positive and negative. For example, the filtering associated with PKP saved people time in terms of searching for information and at the same time this process was seen to limit the range of articles and points of view represented. Likewise there was great access to information and at the same time questions about its quality.

A further issue that was not raised directly by students, but indirectly through their concern over the reliability of information posted on the web, relates to the locus of responsibility for making judgements about material published on the web. Certainly, some students assumed that the PKP filtering process was an indicator that the material located on this site was reliable. While considerable vetting had taken place in the construction of PKP, and while annotations were provided for each article, the broad range of material presented on the site and indeed the very nature of much web based material meant that it had not been subject to the review and editorial processes associated with the publication of a book or journal. Thus responsibility for evaluating the worth of these ideas fell ineluctably onto the shoulders of the individual reader. Whether the students had the time, and/or for some, the skills, to engage in this sort of critical reading is open to question.

Questions surrounding the credibility of web based material and how students used that material as a resource for research and, more specifically, to justify an idea, were raised in a taped conversation between Linda the instructor, Lisa Korteweg and myself. Linda made the following observation:

I don't think this is confined to online discussion but it is certainly highlighted by it - that students inquiring into teaching and learning are inclined to think that any research is OK research, so if I can cite that research site, that if I can cite that a study was done somewhere, then that is the beginning and end of my need to justify what the research has actually said.

While this was acknowledged as a problem with any resource, Linda made the point that it is:

...suddenly highlighted because you have got this immediacy of let's just go to a link and that is enough.

I think the point that Linda was making was that this form of linking and citation needs to be questioned on two fronts. The first front is associated with the means by which students assess the quality of material on the web and the second front is how students use the electronic material to create or support an argument. In relation to the second point it is worth noting that some 25 citations were included in contributions by way of providing a link to a relevant site with little or no elaboration. While I would argue that in most instances these links were intended to only be discussion starters, it does nevertheless raise questions about the range of ways that web resources were or can be used and the implications that this has for processes of online inquiry and argumentation. What emerged from the discussion with Linda and Lisa was a sense that the availability and use of online resources constituted a teaching problem in terms of the actions that an instructor may need to take to assist students to find and critically analyse web resources. Likewise, the manner of constructing arguments and the possible variation between the citation processes associated with this form of online inquiry and other more formal pieces of academic writing and research were also seen not simply as problems associated with the technology, but also as problems that can and need to be addressed through teaching practice.

Connections to Experience

A common feature of students' contributions to the online discussion was their reference to personal experience. Students drew on both their own school experiences as well as those of their family and friends, and their practicum and university experience to support and extend their contributions. Below are some examples:

Good computers don't do much good if no one knows how to use them properly. In my experience in schools it is usually pretty non challenging work that goes on with computers.

The price tag for computers is frightening! Didn't the Hyperstudio instructor say that parents at her school had raised \$40,000 for new computers? And the guy from the library told us today that they'll all be outdated in three years.

Although the students need the skills. I believe that integration [of technology into the curriculum] is the route to take. I do not have a lot of training and I have learned everything I know about computers through hands-on application on the job. In my practicum school, my sponsor teacher goes to great lengths to try and integrate technology into different subjects.

What is interesting is that in this medium students brought a personal perspective to bear on the topic. In the focus group discussions students said that they would typically not do this in a formal essay. In other words they would not write from a first person perspective, nor would they talk about their own experiences. Yet bringing these experiences to bear on theoretical matters and on the production of a text the production is advocated in both the general literature on learning (Wells, 1999) and the teacher education literature (Wideen et al., 1998). This is seen as fundamental to making sense of both theory and practice.

Thus far I have attempted to document some of the connections between people and ideas that emerged through the on-line discussion. I have looked only at single contributions. In the next section I will examine the connections across threads and the substance of those connections. My concern will be to consider the extent to which the on-line discussion assisted students to integrate different parts of their teacher education program and extend their professional learning.

Substance of Connections

In this section of the chapter I will consider in detail some extended examples of discussion links and tease out the ways in which they enabled students to make connections between their personal experience, the research literature, campus-based coursework and professional practice. These connections provide key indicators of the levels of intellectual engagement in the activity and of the process of integration. I mentioned above the notion of integrating those ideas that are typically seen as fragmented or polarised in teacher education programs, for example, theory and practice, campus and practicum experience, public and private knowledge, personal experience and published research, 'foundational' and 'curriculum' subjects. Part of the purpose of the on-line task was to assist students to make some connections not only between people

and ideas but also in ways that bridged the sometimes disparate parts of teacher education programs. Whether and how it did this is the subject of the following analysis.

The actual way in which the discussion was presented encouraged students to make these substantive connections. Part of the task was to consider issues related to technology, equity and education in light of possible action that could be taken by teachers in schools. Further, the period for contributions encompassed both campus-based classwork and a practicum experience. Thus students could draw on school experience to inform their ideas and see how the ideas developed over a period of time. There were many cases, as shown in some of the examples in the previous section, in which students related their action and observations in schools to the discussion. Thus far I have not examined how these layers of connections might develop through a series of contributions, in ways that represent progressive building of knowledge and understanding or in ways that assist students to integrate various program parts. These multiple layers were not common across all the forums. Some of the topics, experiences, resources and forms of interaction did not lend themselves to making direct connections. Those topics with which few direct connections were made to school experience were those concerned with business sponsorship of computers in schools and the moral dimension of children's access to the internet. However it is of value to examine those cases in which some interesting connections were made by way of making explicit the pedagogical practices underpinning the connections and the degree to which they extended students' professional learning. Two examples will be considered - the discussion concerned with gender equity and the ones concerned with teacher education and equity.

The Gender Equity Discussion

The discussion concerned with gender, technology and education provides a good place to start. It was through discussing this topic, more so than others, that students were able to make the strongest connections between the discussion, past experience and future action, between research and practice and between concepts and action. The gender and technology discussion started with the following contribution.

In the GenTech Research Findings Final Report by Mary Bryson and Suzanne de Castell, they stated "evidence from research on gender and access to, and uses of, new information technologies (NIT's) indicates that in public schools, female staff and students (in comparison to male students) are: (a) disenfranchised with respect to access and kind of usage, (b) less likely to acquire technological competence, and (c) likely to be discouraged from assuming a leadership role in this domain."

It is obvious from the references cited in this article that there is a lot of research out there regarding this statement. I think it would be interesting if we discussed any one of the three areas mentioned. A question that comes to mind is are female and male users of technology using technology for the same purposes?

If you would like to read the final report before responding, here it is: <http://www.educ.sfu.ca/gentech/research.html>

There are several parts to this contribution that are of note. First, the student began her comment with reference to a set of research findings that she had located on PKP. By quoting the research summary she identified three issues worthy of discussion and suggested that those in her forum choose one of those three areas for further investigation. Second, the student asked a questions that provided another starting point for discussion. Third, she provided her fellow participants with a reference to the report that she had read, if they wanted further information. Her suggestions and questions were based on the need to find out more information about issues in gender and technology, and on the assumption that research may shed light on these issues. Given that this was the opening comment in this discussion the student took on an important pedagogical role. She established some parameters for the discussion and provided an example and model for a mode of inquiry.

This student's question was picked up by others in the discussion. Two responses both talked about examples in which differences between the patterns of computer use by males and females were reported. They reported that typical patterns of use indicate that girls are excluded from or are not interested in many computer programs that have been developed. These students' comments stemmed from articles and reports that they had found on the web. In noting reported differences between male and female use of

computers, one student talked about the ways in which various companies, such as those responsible for Barbie dolls are producing software that is designed to appeal to girls:

Barbie is trying to change this situation. They have come out with Barbie software to market to the 6 to 16 girls market. What do you feel about this type of software for girls? Here is one quote from the article I read:
Anything that develops computer skills is good," says Julie Sheridan-Eng. "Even if it's just point and clicking; they don't feel intimidated by it."
(<http://www.educ.ubc.ca/faculty/ctg/pkp/gender/issues/index.html>)

Here again, this example and the associated question extended the discussion.

Furthermore, the student provided background to one perspective on the argument by quoting from an article found on the PKP site. The quotation provided a flavour for one perspective on the value or otherwise of this software. The same student made a further posting after searching for related sites beyond PKP:

Boys and girls do have very different attitudes about computers. Some researchers have found that boys are more interested in competitive games, while girls are more interested in word games, art, music and adventure games. Companies have realised the importance of catering to the female market so that means web sites, especially for girls. Here are a couple to check out.
<http://www.girltech.com>
<http://www.smartgirl.com>
<http://www.troom.com>
Do you feel that these web sites are just perpetuating gender stereotypes or are they valuable for getting girls 'hooked' on the net?

In the above comment the student made a categorical statement about the different attitudes that boys and girls have to computers. The strength of this statement appears to rest on the work that some researchers have done. Unfortunately she did not cite a reference for this research. However what she did do was provide some links to web-sites that have been designed for girls by particular companies or groups. Note that the student did not pass comment or talk in detail about these sites. Rather she offered them as sites to 'check out'. She then asked a question that was more specific than her previous question and in so doing framed a debate by presenting two perspectives on websites designed for girls: these sites perpetuate gender stereotypes, or these sites encourage girls to use technology which is better than not using technology.

At this point Carole, the external participant, entered the discussion. At the time of the discussion Carole was a technology and resource teacher in an elementary school. She began her contribution to the discussion with two postings. The first was to introduce herself and to link in with the general ideas being raised in the discussion. The second was to present her own point of view on the issues embedded in the Barbie Doll debate. Here are excerpts from her two contributions:

Why Barbie for heaven's sake? The woman whose body proportions are so out of whack to be laughable, who has never in her fifty year lifespan had a career and who devotes herself completely to fashion... Unlike the teacher quoted in the article, this software is not something that I could ever - in good conscience - present to a girl in my classroom. I think the Barbie-as-airhead message undoes any of the perceived good gained by just "pointing and clicking".

Here, in a fairly straightforward manner Carole outlined her position. She rejected the argument that any technology use is better than nothing. She also related the debate to the ethical stance that she would take in her own classroom. In saying this she contextualised the discussion in ways relevant to teaching practice.

Carole's other contribution was an introductory one, where she outlined her experiences with technology and her interests in technology and gender issues. In saying this she made a connection to the opening comment in the discussion thread. This was a reference to the work of Dr Mary Bryson, a researcher at UBC.

Dr. Mary Bryson worked closely with our school to help us identify goals for technology and then to select appropriate software and hardware to achieve them. Conversations with Dr. Bryson helped me to acknowledge the power imbalance that exists around girls and technology, and I tried to ensure that this imbalance did not prevail in my classroom.

The fact that Carole was familiar with Mary Bryson's work proved to be a fortuitous connection. Much of Bryson's research pertains to gender and technology. Carole's comment provided an explicit connection between the ideas developed by a researcher with the ideas developed by a teacher. I believe this was a small but significant connection between research and practice. Further, in acknowledging Bryson's influence on her thinking Carole identified power issues as being fundamental to questions relating to gender and technology. This brought a clear political dimension to the discussion.

The comments made by Carole were extended by one student. She did this in three ways. Each of these three ways shed light on the process of inquiry and the pedagogical role that this student adopted. In the first instance she linked to a web-resource by way of agreeing with Carole on the Barbie issue and supporting her own opinion.

I agree with your opinion on the Barbie software. I feel the girls may be interested in it because the majority of them have been exposed to her since they can remember. I believe if girls are introduced to software that is engaging and thought provoking, presented in an interesting package, they would be excited about technology. After all, on the following web site, <http://www.educ.ubc.ca/faculty/ctg/pkp/gender/issues/index.html>, in the article called Gender, Computing and Kids, it is stated that "girls often use computers to accomplish a goal", not just for the sake of interacting with Barbie for example.

In the above example the student has linked the specifics of the Barbie software to a more general article on gender and technology. Carole's comment and the research helped to both inform and support her point of view.

In the second instance the student extended the discussion by asking questions about the experiences of other participants. These questions also helped to create a context for the discussion in ways relevant to those working in schools. The questions referred directly to the classrooms that the students had been visiting each week as part of an initial practicum experience.

Have any of you observed situations in your classrooms where you felt the software was appealing to both genders? Did you observe one gender playing more than focussing on the task at hand?

In asking these questions the student was wanting to consider the ways in which the experiences of those engaging in the discussion concurred with the findings that have been reported in the research and other documents that they have read and/or previously discussed.

Third, the student asked some more particular questions of Carole based on her comment about power. The student asked Carole to specify the strategies that she adopts in her own teaching. In asking this question the student acknowledged that she might not recognise

how power operates in the class context and that she wanted some practical strategies that would address the problem.

Carole, I am also interested in hearing about the specific changes you made to your teaching style and the selection of models and mentors you made in your classroom. Also who did you allow access to in the computer lab at lunch and recess? Did you permit those students who showed initiative and productive working habits, or did you allow access to those who did not have computers at home? What were your strategies because as a pre-service teacher, I am not all that confident I would recognise the power imbalance you are talking about.

This to me seems to be a really important set of questions because it brings together a complex concept such as power and the practical action that a teacher could take in relation to the power-based inequities that may exist in a classroom. The student in this case was making connections between theoretical concepts such as power and practical action in a classroom.

Carole replied in detailed ways to this set of questions. She talked about her own position as a technology expert in a class and school and she talked about specific teaching strategies she employed in her class to share expertise. She also talked about the particular software that she used and the strategies she employed to ensure that there was equitable access to and use of computers amongst boys and girls. An excerpt from her reply is presented below.

During class time I intentionally pulled together small groups of girls and taught them one new skill, then asked a question like, "I wonder how you could use this in your report?" and walked away. Similarly I selected groups of students (boys and girls both) and made them experts in the use of specialised hardware like the digital camera, projection unit and the scanner. When other children needed to use one of these extras for their work, the class experts were the designated mentors.

Carole's response to these questions fleshed out some of her theories of teaching and technology. In so doing Carole acted as a mediator for some of the ideas presented by Bryson and de Castell.

The timing of the discussion which encompassed a practicum experience enabled students to both predict future action, come back to points already raised in light of their experience and to make connections with other parts of the course and program. In the first example one student suggested that her awareness of gender matters would inform her thinking during the practicum:

I am going to be teaching computers in my practicum next week, so I will be conscious of the power struggles that may be going on, and how I can help facilitate a more equitable environment.

In the next example a student made connections between the discussion and what she saw on the practicum:

At my school I did see a very large gender gap between who was using the computers. During the class, it was the male students who wanted to go to the computer lab. And after school in the lab it was filled with male students... It is obvious our computer lab is not enticing and meeting the needs of the female students. It was very discouraging.

In this third example students returned to the Barbie Doll debate. What was most interesting was that a student drew a parallel between Barbie and girls' use of technology and Pokemon cards with 'reluctant' readers.

I'd like to look at technology in the same light as reading. If a child has a lot of problems reading, a strategy used may be to let the child read a children's book even if the parent/teacher disagrees with the content, for example "Pokemon". At least the child is reading. Is this not the same with computers?

In raising this point the student linked to topics covered in the Language Arts course, established some broad principles for the debate and brought to the forefront the relationship between the means and ends of educational practices.

As a fourth example, two of the students in the gender forum drew on the resources and the discussion to write the term essay that was part of the Education Studies course. One of the students was in the focus group discussion and she permitted me to read her paper. The student incorporated the following into her paper: references to the on-line discussion and to the external participant's ideas; references to documents located on PKP and other web sites and her own experiences in schools. In doing this the student was able to refine and systematise the ideas raised in the discussion. The student

acknowledged that the discussion provided her with the background necessary to structure an argument.

Two of the students in the gender discussion group were also participants in the research focus groups. When talking to them about the connections they were able to make between the on-line work and their school experience they indicated that they made many connections. They attributed this to two factors - the topic and having Carole. The topic - gender "because it is in every classroom - you can see it everyday". Second, "Carole talked about Mary Bryson. She [Mary Bryson] came into their school and made some practical suggestions... and then that kind of linked to what we found on the PKP forum". As mentioned before the connections between people and topics in this forum were co-incidental, nevertheless what they highlight are a useful teaching and learning dynamic:

- A researcher develops ideas that are both highly theorised and practical;
- A teacher interprets those ideas and develops strategies in response to them;
- The teacher talks about these conceptual and practical ideas with student teachers;
- Student teachers read the research, talk to a practitioner who has interpreted this research in a particular way and relate it to their own experiences.

In association with this dynamic the student teachers were able to make connections between the topic, research, theoretical concepts, teaching practice and their own experience. This seems simple in the saying, but it is a model that is surprisingly rare in teacher education.

The gender discussion was the clearest case in which substantive connections were made between people and ideas. In this case students drew on their experiences and values, the ideas of their peers, the external participant and electronic resources to engage in the discussion and construct a text. Certainly the students who participated most actively in this forum found it to be valuable. In the other forums, connections that bridged the theory/practice and campus/practicum gap were not as strikingly obvious. The topics and the available resources were not so related to the immediate school context or students' initial understanding of that context. In some case students changed topics after the practicum to make connections, in other cases the discussions discontinued. Nevertheless

in some forums certain lines of discussion developed that showed some surprising connections between ideas. One surprising set of connections related to teacher education and equity issues.

The Teacher Education and Technology Equity Discussion

Another topic that was widely discussed was technology and teacher education. While this topic was not necessarily a focus area for some of the forums it is worth noting that it was raised as an issue in six of the seven forums. Some groups came to this at the end of the discussion, some started with this and others addressed it in passing during the discussion. A common theme in these discussions was that teachers' access to and knowledge of computers is an important factor affecting not only the efficacy of computer use in schools, but also the equity of that use. While it is now generally recognised that funding for teacher education is essential if computers are to be used in educational institutions, this is generally a pragmatic matter concerned with implementation.²² It is less frequently construed as an equity issue. Below I document how some of the students made connections between teacher education and equity issues and how they drew on experiences, the comments of others and the literature to do this. The two comments below serve to lay out the issues from the perspective of two students:

The inequity I was thinking of is this:

- teachers have different skills and levels of experience;
- the students of those teachers will have differential access to technology based on how much teachers take students to the lab or integrate computers into a classroom.

I fear that many of the discussions of inequity revolve around students and/or infrastructure required to accomplish goals ... The role of equity with regards to teachers seems to be left out at times.

This comment served to frame a broad set of questions concerned with the relationship between teachers' technological knowledge and students' equitable access to technology education. These questions were fleshed out by students in a variety of ways and across forums. The example below shows one way in which a student drew upon the reading of electronic source material and her personal experience to construct a similar argument:

²² See, for example, a statement made by the BC Minister of Education, Paul Ramsey (1998)

"B.C.'s education technology plan states that the minimum student to computer ratio in elementary schools should be 6:1 (3:1 or better being an ideal)".

(<http://www.educ.ubc.ca/faculty/ctg/pkp/day2.html>). I realise that one of the public's equity concerns, relating to education, is whether or not children will have access to computers and computer software. However this concern needs to be broadened. In my opinion the problem of there not being enough computers for everyone in the elementary schools is a very real concern. Yet, what happens to those ratios when the teachers of those schools have only a few staff members who are technologically proficient? I was in a school where the teacher had a problem printing the class assignments, and there was no one she could turn to for technical support.

In this case the student presented the standards for student/computer ratios in British Columbia schools. This information was obtained from a newspaper article that was located on PKP. She extended the debate by suggesting that this was only one part of the problem. Teachers technological competence was another part of the problem. Her argument was supported by something that she had observed while in a school. An important theme underlying this student's statement was the connection between equitable access that students have to computers and teacher education related to technology. The literature on teacher education as it pertains to technology is typically not framed in terms of equity issues. Moreover, the literature concerned with technology and equity in schools is typically not seen in relation to teacher education.

What I found interesting and also instructive about these discussions were the varied ways that some students made the connections between teacher education and equity explicit and rendered the problem as complex and beyond simple solutions. The following exchange is one example. This thread of contributions shows how students were able to link their readings and experiences related to this topic.

Of course we believe that there are tremendous inequalities that exist in terms of hardware, but I believe that a student's educational experience with technology is affected to a much greater extent by his or her teacher's knowledge/experience/skill with technology. I believe that this point is partially supported by the quote I pulled off the PKP forum.

This students' point is similar to the two above. The following posting responded to and extended this comment with reference to a study concerned with technology implementation.

Would having a full-time technology specialist in the schools reduce the amount of inequality that would exist? Granted this may be a band-aid solution to a complex issue. This idea came to me as I was reading an account of an article that I found on PKP. It was an account of several elementary schools that had implemented a technology project to teach computer literacy to students. The computer co-ordinator, the staff member with the most computer related experience, was seriously burned out by the end of the project because the responsibility of trouble-shooting in the lab was added to his or her classroom duties and obligations.

<http://www.educ.ubc.ca/faculty/ctg/pkp/gender/projects/index.html>

What is of note in this case is that the student was able to extend the level of discussion beyond the rhetoric about what should happen by referring to the pragmatics and problems associated with implementation and to relevant readings. Her comment is important because it holds in relief the very complexity of the technology problem - a particular conception of technology use (based in this discussion on equitable use for students) and the logistics of implementation. The above contribution drew the following and affirmative response from one student. This student made a connection between the posting and his personal experience.

Your comments are totally "on". I actually observed the situation you described in an elementary school last year. The one "expert" never got the time to do the wonderful things that he wanted to do with his class because he was so busy troubleshooting and assisting other teachers.

Questions pertaining to teacher education became prevalent when the students reconnected to the discussion following a three-week practicum experience. Indeed three of the forums that had, prior to the practicum, discussed the ethics and equity of business partnerships and private funding as a means of providing computers for schools shifted their attention to this topic. In so doing they argued that funding was one issue, use was another and that it was little use spending money on hardware and software if the technology was not going to be used to its full capabilities. Here are some ways in which students conceptualised their ideas:

I am not sure how they got the money but that is not even what I want to talk about. The whole time I was in the school I did not see anyone use the computers to half of its capacity. For example my class used the computer lab to practice their typing and to do good copies of their work. I really hope the school did not spend all of this money to have really fancy typewriters.

The student questioned both the efficacy and ethics of spending money on such expensive tools. Comments similar to this were made by a number of students. In so doing an interesting Catch 22 related to the balance between teacher education and computer capabilities was highlighted. One student argued:

I did frequently see computers being used as big expensive typewriters. I am worried about the PERPETUAL LAG between what the teachers know and the types of software and computers in schools.

Here the student suggested that the teachers in her practicum school did not have the knowledge to use the equipment available in schools. The following contribution suggests a different sort of lag in which the technology available in schools did not match the skills that students had acquired in the pre-service program.

In the CITE program we have learned how to design web pages, place opinions on forums, research resources on the web ... and so on. ... Because of a technological lag with hardware and software used at UBC and what is found in public schools, I find myself wondering how effective my skills will be. ... It is great to have technologically wired pre-service programs, but how effective is it when funds are not available in the schools for the equipment to teach what I have learned?

When these different experiences are juxtaposed the complexities associated with technology implementation in schools are revealed. The balance between up to date technology and teacher knowledge and skill in the above cases was elusive. The following comment further extended the discussion:

The push to be ever-"advancing" in terms of new technology sometimes overwhelms reason and thriftiness, producing situations like David just described, where there are four new computers of questionable value... not considering whether there are even people in the school who know how to use it, or whether the school is suitably wired, or how valuable the new piece of equipment will be to students' development and learning, or finally, whether the money could have been more usefully spent on something else such as books, art supplies, science supplies ... the list goes on.

In making this comment the student was not only critiquing the expansionist discourse often associated with technology, but also rendering the problem as complex and beyond one or two single issues.

One student entered the discussion on teacher education by referring her peers back to an article on PKP.

If you are interested, I found a good article discussing equal access to the effective use of technology and it discusses teacher training and the distribution of teachers. It is called "Equity and the 'Big picture'". Go to the site below to have a look:
<http://www.educ.ubc.ca/faculty/ctg/pkp/funding/issues/index.html>

This was the only case in which a student linked to a resource during the post practicum discussion. What strikes me as important about this comment is that a student was taking responsibility for, as well as showing an interest in, linking the discussion based on practicum experiences back to some issues found in the literature. It would be interesting in future discussions to see if students could find more relevant literature after the practicum.

A key point to note from the ideas raised in the above contributions is that the on-line discussion was able to continue after a practicum experience and over a period of six weeks. The fact that there was a written record of the discussion enabled students to review their comments made in the initial stages of the discussion in light of their practicum experience. This in and of itself required students to think about the connections between the on-line activity and school experience. For some, this helped them to look at the issue from a range of angles, and as in some of the examples above, to refine or clarify what issues were most pressing in their practice setting.

In the discussion of teacher education and equity little attention was given to the social factors that might underpin inequities in teachers' and student teachers' access to technology. Two of the external contributors linked teachers' technological knowledge to gender yet this was not picked up in any detailed way by the students.

I did notice an alarming trend among my peers, however. I used to think that female teachers of a certain age were more likely to be intimidated by technology. I was very disturbed to notice younger teachers, even those in the early stages of their careers, who were reluctant to use the technology and who struggled with even the most simple word processing tasks.

After ten years experience as an elementary teacher in Richmond I believe it is very important that no computer equipment be bought or accepted unless it is accompanied by a solid budget for teacher education and in-service....Teachers want guidance without feeling 'dumb' for asking (which a lot of female elementary teachers are afraid of - revealing how little they know about computers).

I suspect that one of the reasons that these topics were not developed in the discussions was because of time constraints. A further reason may be that most attention to equity matters within teacher education programs focuses on the situation in schools. There is little that I am familiar with, in either practices or research, that examines the inequities that may exist among student teachers and within program practices. For example, there is surprisingly little research in the field of teacher education that is concerned with gender and equity in teacher education programs, even less concerned with technology, gender and equity.

Thus far I have reviewed and presented my interpretation of the on-line texts. Through the examples in the above section I have sought to demonstrate how a process of inquiry developed through the on-line discussion. The examples presented provide an illustration of how students were able to make connections between their peers, experts and web-based resources. The excerpts taken from the discussions concerned with gender and teacher education also illustrated how students were able to make connections between theory and practice, campus and school and between research and experience. The discussion concerned with teacher education and equity brought new and surprising connections between people and ideas to the surface. What was distinctive about these discussions is that in some threads connections were made between students, experts and resources. What these discussions allowed for were multiple layers of connections between students, experts, experiences and resources. A variety of perspectives were brought to bear on a problem, ideas were held up for others to review in public forums and ideas were constructed through collective action.

Participant Reactions to Substantive Connections

While there was a range of comments about the means of conducting the discussion, most students did see some value in the ways that they could write collectively with others and

draw on resources in order to engage in the debate. This layer of connections is, in and of itself, important by way of creating the standards for a community of inquiry. Fewer students however, commented on the value of substantive connections, that is the value of the discussion in the context of teacher education, particularly for linking campus based work to the practicum, theoretical discussion to teacher action. Many saw the discussion as having little relevance to the school situation. The following two comments, made in the discussion forums illustrate this point:

My school has a great computer resource with Macintosh computers, however I did not notice any relationship between what we had been discussing with big business and the schools. I think that the issue is more prevalent in the US or Lower East Side schools. Richmond schools have a lot of support from the parents and so forth, so I think the [big business] issue is non-existent in my school.

The school I did my practicum at wasn't on-line, so a connection between the topic - Children and the Internet - and my school experience wasn't possible.

When I discussed with students in the focus groups the degree to which the on-line discussion provided useful links between campus and practicum experience one student made the following observations and suggestions:

Topic selection, or a critical question that you were looking into, that could help the flow, keeping it more practical. Because we were able to choose our own questions and I think our group decided on big business because it was something we had talked about before. But it wasn't really a very good topic for this and what was offered within PKP... Even to question things going on in your school and the kind of programs that are in schools. High tech vs. low tech. Like we have old computers in the schools so we don't have web internet. So it has come up now, but that would have been a really good question to look into.

This student was suggesting that it would have been more worthwhile to generate discussion topics from school experience or observations. Further, it was in the discussion after the practicum, in which students talked about the computer issues in their schools, that this student realised that there were differences between the schools in relation to their technological capabilities. She was in a school with far fewer technological resources than some schools, which raised for her a number of questions about the circumstances associated with this.

The above comment made by one student about the importance of topic selection within the on-line discussion is an important if not unsurprising one. Certain topics opened up greater possibilities for making connections between theory and practice, research and action, campus and school. Certain topics had a more substantial set of resources and research attached to them. Certain topics had greater relevance to students' experiences and interests. The issue of topic selection raises other questions about the pedagogical practices associated with the on-line discussion. For instance, how could topic selection have been better established? It is here that discussion with the instructor proved fruitful by way of examining the structure of the on-line task and its relationship to the rest of the course and the other teaching practices that are part of the course.

This on-line activity, as previously mentioned was one small part of a course that existed as part of a campus-based course. As such the on-line inquiry sat alongside another set of practices - face to face discussions, lectures, written assignments, reading print material. How the on-line discussion aligned, or could be aligned, with these other practices was raised as a topic for discussion with Linda, the instructor. Linda made the following points in talking about what happened this year and what she would do if she used this process of inquiry in the future. Her ideas point to existing links between the activity and coursework as well as possible avenues for integration in the future.

I need to build it in earlier to the course and have it connect more to the course.

One thought I had after reading this was maybe the thing to do is to pull out some of the salient points and make this more integrated into classroom discussion. This just becomes another venue. What I tended to do was separate it out from what was going on in class and let it go on-line, in a way that I wouldn't have let it go in class.

In the second point Linda suggested integrating on-line and face-to-face discussion and through this opening up a channel for her own intervention in the inquiry. In some ways this might be a strategy for balancing student autonomy and teaching goals previously raised by Linda.

In the following point Linda talks about the on-line discussion in relation to face-to-face class and essay writing:

It becomes this interesting transition point between chat and essay writing and I think we are trying to find a place for these kind of discussions within an inquiry. It is not the whole of the inquiry, but it is a dimension of the inquiry and it does take advantage of the idea that collaborative discussions bring to individuals different dimensions that they would not have seen if they were doing a research paper on their own, even if they had access to the internet to do the research paper....I think what we are searching for is a way in which the WebCT discussion becomes an intermediary step between talk and writing.

This suggestions opens the possibility for thinking about ways in which writing an essay on a topic could develop from an on-line discussion. The assumption here being that students have already started to formulate, draft and get feedback on ideas prior to writing a substantive piece of work. This point is corroborative of the ideas raised earlier by the one student who wrote her essay on the ideas raised in the online discussion.

While there were ways in which the activity could be more tightly linked to other aspects of the course, it was clear that in many instances the discussion had developed from or was consistent with principles and concepts that had been covered in the Education Studies coursework. For example, Linda had spent time in class generating guidelines for respectful communication, productive discussions, and critical thinking which provided the groundwork for students to be able to contribute to the online discussion in an independent way. Furthermore, in the coursework students had considered notions of equity in education, which provided them with a conceptual framework for considering equity in relation to technology.

Conclusion

By way of concluding this case study, one student's comment stood out for me as a key to understanding the potential for this type of discussion. She said, "I loved writing from my heart and head". To participate this student garnered both intellectual and emotional resources. She was able to write from a personal perspective as well as through drawing on the ideas raised in research and by other contributors. I am not suggesting that all students felt this way or that it is only on-line discussions that make this possible. But in this case the mode, the topic, the interaction between people, the access to resources - the methods of inquiry - enabled this student to engage from her head and heart. This is

important given the chronic separation in teacher education programs between theory and practice - the two sides of this dichotomy being not unrelated to the head and heart dichotomy.

This bringing together of ideas and perspectives was one of the key purposes of the online activity. From the data presented above, there are some clear examples of ways in which the activity fostered these sets of connections. The online discussion provided a medium through which students could structure various pedagogical relations and various connections between ideas and experiences. Key and distinctive aspects of the on-line interaction included:

1. Exchange of ideas in writing across a number of people and beyond program boundaries;
2. Audience for writing;
3. Access to and incorporation of web based resources; and
4. Interconnections between personal experience, other participants and resources.

Parts of the gender discussion and parts of the teacher education discussions provide some evidence for ways in which participants made connections in both form and substance, and in ways that represent extensions to students' intellectual engagement.

Crucial to each of these cases were the levels of collaboration, the nature and relevance of resources and research and the links between the discussion and students' experiences in their practicum schools.

The problems and issues that emerged through the discussion and that could be addressed in further research concern the nature of the relationship between on-line activities and other course activities and the efficacy of using web-based resources. Developing ways in which the online work could complement and link to face-to-face classes and more formal pieces of writing formal pieces of writing could provide a broader and more integrated purpose for the task. Assisting students to find and use web resources in ways that productively and critically inform the discussion and the level of reasoning is important given the vast array of material available on the web.

CHAPTER SIX

THE READING ONLINE PROJECT

Introduction

The purpose of the *Reading Online* project was to examine the degree to which reviewing an electronic journal article in a public forum enabled students to not only participate in a professional community but also extend their understanding of current issues in literacy education. Students had the opportunity to build on existing research resources to construct an article review for the public readership of the journal *Reading Online*. The key argument developed in this chapter is that writing to a public audience provides a means by which student teachers can enter into the discourse of professional communities in ways that change and extend traditional pedagogical relationships between instructors and students. A second argument is that the ideas raised in the articles provided students with some important resources for extending their understanding of literacy and technology relevant to their teaching practice.

Context, Text and Technology

The second case study is based on an assignment in the Language Arts course. The Language Arts course is a significant part of the elementary teacher education program. It is considered to be a 'foundations' course in that it is concerned with the principles of language learning and literacy. It is also considered a curriculum course, with attention being focussed on classroom activities that support the study of language arts, as well as an understanding of the ways in which language and literacy are fundamental to all areas of the curriculum. The *Reading Online* (ROL) assignment was set in the first semester. It was designed to introduce students to some of the literature in the field of language arts and literacy, as well as to a professional community that is part of the readership of the journal *Reading Online*.²³ The assignment required students to read and respond to two articles published in this electronic journal. The responses were to be posted on public

electronic discussion forums that were attached to each article. Students were also asked to document their approach to the task. Students' postings to the electronic forums, and their documenting of the process of inquiry that they undertook to complete the task, constitute the main sets of data to be analysed for this case study.

The details of the assignment task are as follows:

The purpose of this assignment is to develop your awareness of current issues in literacy education and to provide the opportunity to respond to these issues by way of questions or comments analyzing perspectives presented and expressing your point of view. It also introduces you to a wider educational community and provides a means of continuing your professional development beyond this year.

You are required to read and respond to two articles in the following electronic forums.

- Articles (new developments in the field of literacy)
- Critical Issues (includes those currently of concern to professionals in the field)
- Electronic Classroom (sharing effective practices and new developments related to the use of technology for reading, writing, and studying.)
- Research (invited papers from scholars in various literacy areas)

The ideas for this assignment were primarily developed by Jane Wakefield, the course instructor. She was familiar with the journal and also very interested in both integrating technology into her practice and developing student teachers' understanding of the relationship between technology and literacy. Much of her coursework was presented in on-line formats, specific aspects of the course were devoted to issues related to information and computer literacy, most of her assignments had a 'technology' component and she was always willing to experiment with different ways of building the use of technology into her teaching practice. Jane and I had worked closely together on two on-line projects in the previous year and this year we had planned three projects. In working together we spent considerable time discussing the ways in which the *ROL* assignment could be structured, how its purpose could be articulated and the means by which students' work could be evaluated. We also spent considerable time discussing the outcomes of the activities. Thus the analysis of the data presented in this case has benefited from and reflects these discussions.

²³ *Reading Online* is located at web address: <http://www.readingonline.org/home.html>

In building on the ideas that had emanated from our previous work together, key things that Jane and I wanted to develop through this assignment were ways in which learning and engagement could be extended through writing for an audience, participating in a professional community, and using web-based resources. These ideas linked to the learning goals of both the LANE course and the CITE program. The journal *Reading Online*, published by the International Reading Association, seemed to provide an ideal resource and venue for the sort of goals that Jane and I had in mind. The journal publishes a range of papers concerned with language and literacy learning in K-12 settings. These papers are written by both academics and classroom teachers. Papers in the journal were, at the time, classified under the following headings: Research, Articles, Critical Issues, Electronic Classrooms and International Perspective. A broad range of topics are published in the journal. As well, a variety of methods and approaches to presenting topics are employed. Some papers are highly theoretical; others are essays presenting a position on a particular topic. There is classroom-based research, as well as descriptions of innovative classroom practice. A considerable number of published articles are also specifically concerned with educational uses of technology. This therefore provided another venue for students to learn about and gain a critical perspective on technology.

Associated with most of the papers in the journal are public on-line discussion forums. In these forums readers of the journal can comment on and discuss the papers. The discussion forums add another dimension to the journal by opening up each paper for public comment. The purpose of these forums and the guidelines for contributions as stipulated by the journal are as follows:

The purpose of the unmoderated discussion forums in *Reading Online* is to foster the journal's mission of leadership, dialogue, and participation by advancing the professional discussion of literacy issues raised within each section. The discussion forums are not intended to serve as a means for individuals to engage in unprofessional language or dialogue or to post messages that are unrelated to the discussion topic. The discussion forums should not be used to publicize or promote the activities or publications of the individuals who contribute to them. (International Reading Association, 1999)

Readers of the journal who wish to participate in these forums are required to 'sign on'. Readers are then given a password to enter the discussions. All postings have the respondent's name attached to them. Participants can start their own thread or reply to and build on existing comments. These forums provide an opportunity to engage in a discussion about an article with other readers in ways not possible with print journals. Authors, too, have the opportunity to get feedback on their papers from readers. Moreover, in the context of this assignment, student teachers were writing to a 'real' professional forum, with a 'real' audience, rather than writing a review of an article to be read only by the instructor.

The specifics of the assignment requirements are detailed below:

Your responses can be in the form of a question or comment. Responses will be evaluated according to the criteria outlined in the LANE letter grade categories printed in your course syllabus.

- Length. The message is not longer than 500 words.
- Language. The text of the message adheres to the Rules of Conduct for Discussion Forum Participants.
- Professionalism. The message imparts a professional tone that is not argumentative or demeaning to other discussion forum participants. The message clearly seeks to foster the ideals of leadership, dialogue, and participation that are integral to the mission of *Reading Online*.

In this case the instructor developed a set of criteria to evaluate student contributions. Students knew this in advance and could draw on this to inform the way in which they constructed their response. This included an understanding of the content, an analysis, interpretation and evaluation of the perspective of the author, the expression of a point of view through connections to their own experiences and with the ideas raised by other participants. Students had a period of four weeks to post their contributions to the discussion.

The *Reading Online* assignment was not dissimilar to the Education Studies Online assignment and indeed shared some common features in terms of its purpose, mode and use of resources. More specifically, these similarities included engaging in a conversation with other professionals, participating in writing, and using online resources as part of the

discussion. However there were certain key differences between the *Reading Online* assignment and the Education Studies task:

- Responses were built around the ideas raised in one published article. There was a clear frame of reference for what was being discussed, rather than the more general topics that were considered in the Education Studies discussion.
- Students wrote to a wider public audience unlike the limited and known audience within WebCT. While the audience was largely unknown, it was likely to include academics, teachers and student teachers interested in language education.
- There was less likelihood of on-going discussion threads in the *ROL* assignment because students responded to two separate articles each with their own forums. Further, given the public nature of the *ROL* forums there was no certainty regarding whether and how others would respond. Students were however encouraged to contribute to threads and build on the ideas raised by others. By comparison, the Ed Studies Online discussion was structured around threaded and on-going discussion.
- Students were assigned a grade based on both participation and content. In the Ed Studies discussion they were graded on participation only.

In light of the above, students tended to adopt a more formal style of response than they did in the Education Studies task. Most students drafted and edited their responses before posting into the forum whereas in the Education Studies task students typically wrote their response 'online'. Students' contributions tended to blend features of a formal review with features of a less formal discussion with others. Thus, while students focussed on ideas in the published article and while their postings were typically 'one-offs', they also usually wrote in the first person, expressed their point of view, described their own experiences and acknowledged an audience.

Two factors that underpin students' participation in these online forums are worth noting. The first is that of the 39 students in the group, only one had participated in this sort of public electronic forum prior to this experience. Second, at the time of undertaking this assignment students had spent some observational days in schools but had not had any form of sustained teaching experience. Thus most students came to this task with a

limited set of experiences both in terms of use of the medium and the content of the discussion.

The Nature of Connections - People, Ideas, Resources and Experiences

As per the analytical framework outlined in the methodology chapter, my prime concern is to describe and assess students' levels of intellectual engagement in the Reading Online activity. The analysis will focus on processes of inquiry that students undertook to participate in this task. This will include a discussion of the means by which students chose articles, the types of social engagement and interaction within the forums, and the ways in which students were able to make connections between theory and practice, personal and public knowledge, past experience and future action and campus experience and practicum experience.

Article Selection

The first part of the inquiry process for the student teachers was finding two papers to discuss. Students used different means to do this. Most skimmed through the various editions of the journal as well as existing discussion forums. In doing this students developed a sense of the range of articles and topics in the journal and the types of interactions that were taking place in the forums. The articles that students chose to write about were, on the whole, those that had some relevance to their practicum setting or to their other, more general, personal experiences. The following comments by students exemplify this selection process:

I saw the title, "Shakespeare in the Middle School," and was immediately intrigued. I have had personal experience with classroom theatre and believe it has tremendous value, so I was interested to read more.

The second article on reader control of narration rate in talking books, I chose because I could recall these books from my own literacy past, and had recently seen them in my practicum school.

I chose the Kindergarten Stories paper because I have kindergarten students in my practicum class, so I was interested in some practical ideas for encouraging literacy in early elementary school children.

Students also chose articles that presented interesting ideas and that they felt they could respond to with some degree of authority given the public audience.

I chose articles primarily for their titles which I found thought provoking and related to issues that I felt confident in responding to with both comments and further questions.

A couple of students chose articles that had a lively discussion attached to it.

I also chose this article because I was intrigued by some of the responses that were posted on the on-line forum.

I selected this article primarily on the recommendation of a classmate. I was eager to enter into a discussion with some of my classmates.²⁴

The selection criteria employed by students indicate that in their choice of article they were seeking to make connections with their own experiences, with what they knew or with other people.

Topics and Form

Because of this element of choice a wide variety of papers were considered by the 39 students. The topics and articles are listed in Table 5. The number of students who contributed to each forum is also listed.

²⁴ A few students had decided to comment on this article.

Table 5: Topic and Article Selection

<i>Papers</i>	<i>No. of student responses to each paper</i>
Technology and literacy papers	
Electronic literacy in school and home	1
Kindergarten stories: writing and drawing at the computer	5
Institutional applications of information tech	1
Multi-media and effective scaffolding	6
Literacy and cyberspace	6
Critical Issues Papers	
Adolescent literacy	1
Literacy, emotions and the brain	11
General Articles	
Rewrite a music strategy	4
Teaching multiculturalism - focus on people	1
Making and writing words using letter patterns	6
Reaching politicians through the media	3
Wait for me (taped reading)	11
Shakespeare in the middle school	3
Uniting students (testing and alternatives)	8
Literacy in multicultural settings	8
Reading and learning in secondary schools	4

Some of the forums that students contributed to had been in existence for several months and had a number of postings from other readers. Other forums had just opened up in association with newly published papers and so had few or no postings. Some of the forums were dormant in that there had been no contributions for a period of weeks. Other forums were more active and had current postings. Students chose their articles based on topics that were of interest to them, rather than because of the activity taking place in any

one particular forum. Thus they did sometimes enter forums that had been in existence for some months and that were not necessarily 'active'.

To give an initial sense of the ways in which students contributed to the discussion forums one excerpt from a student's contribution is presented below:

Gerald Coles' article "Literacy, Emotions and the Brain" dives into the psychological aspects of learning in relation to cognition and emotions... Coles believes that educators must make the role of the emotions a primary concern. I agree with him completely. I believe that self-esteem is a major factor in a child's performance at school. The more confident I was in a subject, the more I would apply myself to it; therefore my grades would reflect this. If you don't feel confident about a subject or your ability to do well in it, you will not do well in that subject.

In this example the student agreed with the author's views on the relationship between emotions and learning ("I agree with him completely"), she related it to her own school experience ("The more confident I was in a subject, the more I would apply myself to it"), and made a generalised value statement about the issue ("If you don't feel confident about a subject ... you will not do well in that subject"). This example demonstrates a common pattern in the ways in which many students responded. This pattern included acknowledging the ideas presented by the author, identifying an issue or topic, linking the topic or idea to a personal experience, and on the basis of the previous two points, making a general statement about literacy and language learning. Other less common forms of participation included linking to comments made by others, linking to ideas raised in the teacher education course, connecting to articles published in the journal, asking questions and extending ideas. The above forms of participation were coded across all student postings ($n = 78$) to provide a numerical sense of this pattern (Table 6).

Table 6: Forms of Participation

<i>Forms</i>	<i>No.</i>	<i>%</i>
Identifies issues raised by author	71	91%
Develops point of view/generalised statement	57	73%
Links to personal experience	38	49%
Links to teacher education program	13	17%
Links to other contributions	15	19%
Asks questions	17	22%
Extends ideas/provides ways of experimenting/future application	10	13%

The coding shows, not surprisingly, that in their responses most students talked about the ideas raised by the author and made a general statement related to language and literacy learning based on these ideas. In about two thirds of the responses students referred to either their own personal experiences, or experiences in their teacher education program, by way of making sense of the article or in order to support their point of view. About 40% of the responses showed students explicitly and deliberately seeking to engage with others through links or questions. A small number of contributions (13%) contained practical suggestions that sought to extend ways in which ideas could be integrated into classroom settings.

Having done this brief overview of the ways in which students participated in the forums, I now want to turn to examine in more detail the connections that student teachers were able to make with other people and ideas through these ROL forums. An analysis of the students' postings as well as their reflections on the task reveal that the ROL forums provided useful and sometimes surprising ways of connecting people and ideas. Through these connections students began to engage in a wide professional community made up of teachers, student teachers and academics with an interest in language and literacy education.

Social Interaction and Connections Between People

The *Reading Online* task provided various layers of connections between students, the instructor and those who read and write for the journal. While there was only a limited amount of on-going interaction between participants in the forum, I will argue that it was the fact that there was a public audience that proved to be crucial in terms of extending students' intellectual engagement in the activity and enhancing their participation in the professional community associated with the readership of this journal.

There are various forms of interaction between those who contribute to the online journal and participate in the discussion forums. In the first instance student teachers were reading and responding to the ideas presented by authors of published articles. Student teachers' responses in the discussion forums therefore built on these ideas. Being able to respond directly to articles in a public forum is one of the unique features of this journal and serves a useful function in terms of rendering research and practice more accessible and more open to discussion than print journals. A process of inquiry and knowledge construction does not stop with publication. Thus readers, in this case student teachers, had the opportunity to be a part of that process through this electronic means. Students thus wrote knowing that the author of the article may read their postings.

In the second instance students had a strong sense of writing to a public audience. This sense of audience, and each student's position with respect to this audience, is a critical factor in understanding the nature of engagement in this activity. The following comments by students show how they saw themselves in relation to their audience and how this influenced how they approached the writing task. There is considerable variety here, but what each example demonstrates is a complex link between students' conception of audience and their own social role; the writing processes they adopted; how they talked about the topic and how they understood the social and rhetorical purposes of the activity. Negotiating these factors was crucial to the process of learning to participate in this activity. For some students there was a degree of nervousness and uncertainty regarding how to write given the audience and/or their own lack of experience and authority in this field.

It was more stressful knowing that anyone could read my thoughts. I felt quite intimidated posting a response with so little experience to draw from. I didn't really feel like the world wanted to hear my personal reflections. It was hard to know if I was to write something informal like an email or if it should be more like a well-researched paper.

For this student the uncertainty concerns her relationship with her audience and how this might influence the formality of her writing. The comment below also expresses the same degree of uncertainty regarding a student teacher's position with respect to their assumed audience. In this case her concern is with the content of her posting.

I was quite intimidated with this assignment because it is one thing that my peers read my responses, but I find it a bit scary that teachers and other professionals would be reading my responses. I still think of myself as a student and not a professional quite yet. I also didn't want to offend anyone with my response, so I took great care in preparing my response.

In this case the student made explicit the relationship between her position as a student teacher and the care that she took in constructing a response. In a similar way some students stated that they were student teachers by way of indicating their own position and used this as a means of qualifying their statements:

When I posted my response I felt really uncomfortable because I do not have background in this area. I am learning and absorbing. I mentioned in my response that I am a pre-service teacher, primarily to insinuate that I am a beginner learner in this field.

For another student, knowing that the author might be part of the audience proved to be somewhat problematic given her thoughts about the article:

I also found it hard to make written comments about the article knowing that the author would be able to read my response. For example, I found that the author was not convincing in the example he chose to back up his thesis.

This sense of audience and social position is an indicator of the process of contextualisation that students undertook to learn to engage in this type of forum. It begins to provide part of the explanation for what was written and not written and the processes adopted in writing.

Of the 78 contributions made by student teachers, 49 (63%) were 'stand-alone' responses to the articles. In other words much of the effort in the assignment was oriented toward responding to the article, writing something appropriate for the public audience and

hoping or wondering if anyone would respond. The following comment by a student on how she engaged illustrates this point:

Once I had finished writing my responses I got very nervous to post them. I think I was worried because I was not sure who was going to read them. Once they were posted I felt proud of myself and made my friends check out my responses.

Other students sought more deliberately to draw on and engage with other forum participants. 29 (27%) responses contributed to an existing thread. Some students reported that they consciously endeavoured to provoke discussion within the forums and it is here that it is possible to see some of the ways in which some form of interaction and dialogue took place between forum participants:

I also tried to tie in my response with comments that were made before me – trying to engage in some form of dialogue if possible.

I also wanted to include comments and questions to the people who had read the article, not just to extend their thinking but I also hoped to receive a response or comment on my on-line response.

Below are some examples of different ways in which students did this in the forums. In some cases it was agreeing with others:

I agree with Melinda, Chad and Leslie that there needs to be a balance between computers and traditional classwork.

In other cases it involved seeking practical strategies:

If anyone has any pointers or would like to share their experience with Making and Writing Words I would be interested to hear about them.

In other cases it was more provocative. In the example below a student took a strong stand on an issue and asked questions of readers at the same time.

In today's schools it is inevitable that we will have students in our classrooms who are more proficient at computers than we are. The question that I would like to raise is what do we do with these students during computer class?... The most common suggestion that I have heard is to give these students a peer teaching role. While I think some children would benefit from this suggestion, I believe in many cases it is an easy way out for teachers. These students do all of the computer "dirty work" and help cover the teacher's inadequacy with technology. What do you think? Any other ideas?

In the next example the student took issue with the ideas raised by one of the forum participants.

I was quite surprised by [discussion participant's] response to this article... He says we should get off the emotions and get on with learning how to teach our kids better.

In a less obvious way students also drew on the existing forum contributions to get a sense of the conventions associated with this form of writing. Whilst not explicitly acknowledged through links or citations, existing comments provided ideas for the form and content of responses as the following student comments demonstrate.

It was helpful to read what others had written. This gave me some idea about how formal of informal to make my response and how long the post should be.

For both my responses it helped a great deal to read the other responses so I could feed off their ideas and opinions.

Similarly many students commented that they spoke to their classmates by way of thinking about their response.

I invited a friend to read the article so we could have a conversation about it and do some collaborative brainstorming.

Before starting to compose my response I bounced ideas around with a fellow classmate.

Students' participation in these forums also show how they were learning a genre or a style of writing, in what for many of them, was an unfamiliar context. The key point here is that students were learning how to participate in a professional online community. That community was a site where students could extend their levels of professional engagement beyond the four walls of the classroom and beyond the boundaries of the CITE program. As one student said

I think the forum is especially good for learning about what teachers in other places have to say.

Sustaining Discussion

Both the instructor and I hoped that the students would engage in some form of dialogue with other forum participants, and as the above comments indicate many students also hoped that there would be some response to their postings. From the instructor's perspective, comments which built on or assessed students' contributions were important to a process of inquiry, professional conversation, as well as interest in the activity. Any

form of sustained dialogue did however prove to be difficult in this context, particularly given the time frame of the assignment. In forums such as these there is little by way of social obligation to reply to any postings. In addition, as mentioned previously, some forums sustained considerable discussion over a period of months, others had very little discussion. Another dilemma associated with the attempt to develop discussion within the forums concerns the motives for contributing and the frequency with which people return to the discussion forums. Certainly the motivation for students to participate in the forums in this study primarily existed during the four-week period connected with the coursework and associated assignment requirements. Students had other sets of priorities once they had completed the minimum two postings and they had little time to go back and check postings.

During this assignment period, other than replies from classmates there were no responses from the general public to any of the students' postings. However in the four weeks following the initial postings there were 35 replies or extensions to student contributions. Seven of these 35 replies were from the authors of the published papers. In many ways it was unfortunate that during this time students' attention had shifted to their practicum experience. As a consequence they had little time to read or respond to any of the extensions to their comments. Moreover, many students did not really get a sense of the social or dialogic potential associated with the forum. As one student said:

This new technology is definitely something to get used to - communicating online requires patience in waiting for a reply.

Sustaining any dialogue between students and others in the discussion was in this respect difficult. It raises questions about the time needed to sustain some form of interaction, especially in ways that assist those involved to clarify or resolve ideas. The instructor noted that it would require rethinking the timing of the task in ways that would better enable some on-going interaction with other forum participants over a longer period of time.²⁵

²⁵ It is also worth noting that the means of participating in the *ROL* forums has been changed. There is now a discussion moderator and this person focuses the discussions more deliberately on recently published articles. In this respect there is more chance of some on-going debate related to particular articles.

The comments provided by one student who did have a reply to her posting are useful to consider. In this case the author of one of the articles replied in detail to one student's posting. In that reply he agreed with the student but encouraged her to develop ways of assisting students to critically appraise the media they are using to locate information.

Joanna, I entirely agree with your thoughtful comments. The electronic medium has to add real educational value, and we need to be teaching our kids critical thinking skills so they can appraise the relative merits of different media. Any medium has to be fit for the current purpose.²⁶

This student was very surprised that an author would respond to her work, even more so when she discovered that the author was well respected in his field.

It was incredible to actually have a personal response from the author... which I never imagined would happen. I felt like I was part of a real professional conversation.

While this student did not actually respond to the author's comment she did develop an interest in the work that this author was undertaking in Scotland, and she would often check the forums attached to the two papers that he had published in *Reading Online*. What is noteworthy about this example is that the forum provided the means by which the author and the student could express an interest in each others' ideas and see ways in which those ideas related to one another. The interaction in this case did much to reduce the distance, both literal and metaphoric, between author and reader, and between researchers and practitioners. The response to the student's posting was also extremely valuable by way of assisting the student to validate and justify her ideas. I will return to this later in the chapter.

Interaction with Instructor

In completing this task students had to negotiate two roles - as members of a professional community contributing to an on-line discussion and as students being assessed on their learning. Three students noted in their reflections that they were conscious of the fact that this was an assignment that would be evaluated by the instructor.²⁷ In their cases the

²⁶ Comment located at:

http://www.readingonline.org/international/inter_index.asp?HREF=/international/future/index.html

²⁷ Neither the instructor or I participated in the discussions.

grading of the postings influenced the degree of care that they took with drafting their ideas and how they participated in the forum:

Had I been less concerned about my spelling, punctuation and receiving a grade for the assignment I would have posted immediately and most likely become engaged in an on-going debate with the other participants involved in the discussion.

While this student was critical of the dual purpose and audience, it shows nevertheless that she was having to make some decisions about the rhetorical purposes of her writing. On the whole however, the comments made by students indicate that their focus was, in the first instance, on making a thoughtful contribution to the forum, rather than writing something simply to please the instructor.

Public Audience

The actual amount of interaction between forum participants, particularly during the period for posting comments, was not great. Nevertheless there are two points that are worth noting about the social interaction implicit in undertaking this task. These two points shed light how this interaction assisted students to learn the language of a professional community. These two things are:

- public forum - students were part of a process of inquiry; and
- audience for writing - students took the task seriously and put a considerable time into working through the article and responding to it in ways that others would find both coherent and interesting.

While there was less progressive and collaborative building of ideas within these forums than in the Education Studies discussion, nevertheless there are a number of examples which demonstrate ways in which the ideas raised in the articles and students' contributions to the forums were translated and transformed in other teaching and learning contexts. In this next section I will suggest that these connections between contexts represent important extensions to student teachers' intellectual engagement in learning about teaching.

Substance of Connections

As indicated earlier, through both searching for and reviewing articles, students were connecting to current ideas in language and literacy education. In this section my intent is to consider the ways in which students were able to draw on the ideas raised in the article and translate and transform these ideas into other contexts and with other people. My particular concern is to identify ways in which this activity was a part of a progressive building of knowledge and of ways in which that knowledge was enacted in practice.

The connections that some students made between the articles and their experiences were 'two-way' in that they considered the articles in light of their past experiences, and they took ideas from the articles to their school experience. It is worth noting that within the actual postings these layers of connections were not necessarily the norm; see Table 6. Moreover, the instructor commented that some of the responses lacked depth in terms of the degree to which they demonstrated links between theoretical and practical issues. Nevertheless, in this instance my main concern is to make explicit the pedagogical practices that enabled some students to connect ideas from one context to another and consider the implications for student teachers' emerging theories of practice. This includes those instances where the ideas raised in the online forum provided a building block for developing more substantive links between campus coursework and the practicum.

I have categorised the connections that students have made between the ideas in the article and other teaching and learning contexts in the following way:

- article ideas/past personal experience
- article ideas/campus-based subjects
- article ideas/practicum.

Article Ideas/Personal Experience

One common feature of many postings was the way in which students connected their own language and literacy learning experiences to ideas raised in the published articles

(see Table 6: Forms of Participation). Students chose to be quite personal in what they revealed as the following two examples demonstrate:

Even when I went to school, I remember having to read various books that I personally would never have chosen. Of course I would read the novel as I knew the teacher was shaping a lesson around it, but for no other reason.

I liked Angela Ward's view that knowledge of several languages should be the mark of an educated person. Like most of the other respondents, my six years of high school and university French left me with the merest smattering of the language.²⁸

There are various reasons for this. In part this was encouraged by the criteria developed by the instructor. In part it ties in with a previous assignment in which students had prepared a literacy learning autobiography. In part it reflects for many students their strongest sense of school experience, given that they had little practicum experience. Further, the genre of electronic discussions may also serve to encourage writing not only from a first person perspective, but also writing about personal experience. Whatever the reason, the important point to note is that these students were able to consider their own language experiences in light of the theories of language and literacy presented in the articles. This is precisely the sort of action advocated in both the teacher education literature and general literature on learning (Wells, 1999; Wideen et al., 1998). Understanding the processes of one's own learning provides a useful starting point for understanding how others might learn and the practices that might facilitate that learning.

Article Ideas and Other Campus-Based Coursework

As indicated in Chapter Two, integrating campus-based coursework is oft called for in teacher education programs and was a major platform of the CITE Program. The ROL activity, in some cases, was a site for integration across courses. The examples below show ways in which students were able to build ideas through these links. In some cases this was because there was coherence across ideas; in other cases students examined different perspectives they encountered in order to articulate their own point of view.

²⁸ Angela Ward's article is located at:
http://www.readingonline.org/articles/art_index.asp?HREF=/articles/ward.html

Some students made connections between the ideas in the article and their language education course. For example, one student argued that the author of one article had set up a false dichotomy between a whole language approach to literacy learning and a skills and strategies approach. In order to counter the arguments developed in the article the student referred to ideas that had been covered in the coursework.

I am an education student and our literacy classes place a heavy emphasis on teaching skills and strategies. However I don't think there is a dichotomy between this and the whole language approach that Coles believes.

In their reflections on the process of contributing to the forums other students spoke about how their ideas had developed through seeing some links between subjects. In the example below the student explained that her interest in one particular article was sparked because the topic had been raised in different ways in some of her courses.

When I saw the title testing and technology I had immediate thoughts on the subject, since the issue of classroom testing has come up in LANE and EPSE, and we are currently working on an Education Studies assignment in which we explore the uses of technology.²⁹

Another student talked about how the ideas from her work in the Language Arts subject and the Education Studies subject provided her with both the background and a method for responding to the article:

I did draw on some of the discussions that have come up from our LANE class regarding literacy... I also took from our philosophical Ed. Studies discussions a way of looking at subjects with a critical and thoughtful point of view, and in doing so I feel that I was able to link what the articles were saying about specific topics to some of the wider issues that they relate to in education.

In two forum responses, students referred to other articles they had read in *Reading Online*. The ability to make a direct hotlink to another web page meant that they could include a reference to the article in the text. Here is one instance:

Another example of good teaching can be found in the article "Double, double, not much toil, not much trouble: Shakespeare in the Middle School Classroom," by Claudia Anne Katz. This article, along with responses, can be found in Reading Online (http://www.readingonline.org/articles/art_index.asp?HREF=/articles/katz/katz_frame.html)

²⁹ LANE stands for Language Education and EPSE stands for Educational Psychology and Special Education.

This student explains her reasons for including this reference:

I felt a need to counter the testing craze with a reference to the amazing article on classroom theatre, so at the end of my response I included a link to the "Shakespeare in the middle school" article.

While this connection is a simple one it is a good demonstration of ways in which electronic resources can be linked. In this case a student could extend her argument with reference to other articles and at the same time suggest to other readers that this article is worth reading. The hotlink means that other readers can easily access this particular paper.

Article Ideas/Practicum Experiences

Making connections between campus-based coursework and the practicum is one of the key goals of program integration in teacher education and thus it is of note to consider any ways in which students did make these connections through the ROL activity. Here I have sought to identify cases in which students drew on their practicum experience or experience in schools to construct their posting, as well as to consider those cases in which students took the ideas from the article to their practicum setting. The figures in Table 6 indicate that 13% of students mentioned their practicum experience as part of their response. This is not particularly high, but not surprising given that students at this stage had only spent a few days in schools doing observational work. Likewise I am only aware of a few cases in which students deliberately and explicitly drew on the ideas from the articles and their posting to inform their later practicum. Nevertheless these cases are important to consider as they serve as exemplars of student's critical engagement with theoretical and practical ideas and help to illustrate the conditions that support this form of engagement.

In some instances students drew on their observations of school activities or conversations with their sponsor teachers to inform their understanding of the article and their response. The two examples below are indicators of this.

In the schools I have visited children are being asked to perform computer activities that lack meaningful connections to the rest of the curriculum. Perhaps Dudfield's article offers a response to the type of meaningless integration of computers into education.

I asked my sponsor teacher about how much control her students have over this teaching aid, and why she uses talking books.

In their responses students also thought about the ideas in the article with reference to their future practice.

Thank you for the idea, I am looking forward to trying it out.

One extension I thought of for this activity is for intermediate age students to devise their own "challenge word"... I have not tried this activity myself, but I will be integrating it with at least one of the themes I will be teaching during the next year.

Some students did follow through with the ideas from the articles in their practicum experience by way of developing teaching and learning activities and by way of reflecting on their practice and refining their understanding of their practice. The connections that students made are not necessarily dependent on the particular ways of communicating made possible through *Reading Online* and it is likely that these sort of connections are made in many other ways. Nevertheless what they demonstrate is how the ROL activity provided an opportunity to articulate and discuss ideas which in turn provided one building block for the development of classroom practices and theories of practice.

Various examples demonstrate how students drew on the content of articles and the ideas from their review during their practicum experience. However rather than list the various cases in which this type of link took place, what I want to do is consider two examples in detail. They are interesting because they are both concerned with students' views of computer technology and they both show how the ROL activity proved to be one important part in developing a perspective on educational uses of computers. In each case there was some convergence between the medium for inquiry, the topic for discussion (educational uses of computers) and classroom practice.

Vignette One

I have briefly referred to this case earlier in the chapter - the author of an article responded to a student's posting. In the article "Electronic Literacy in School and Home: a Look into the Future", Keith Topping (1997) discusses the ways in which electronic literacy at school and home might complement one another, as well as some of the pedagogical, pragmatic and economic factors that affect this relationship. In responding to the ideas in the article the student expressed some concerns about the way that computers were used in her practicum school. She described a scenario in which students were using the library to find information on snakes. The student reported that various print resources were found but that students did not want to use these, rather they only wanted to use web-based resources. The student teacher saw this as a problem for three reasons: books were seen by students as 'second rate'; a lot of time was wasted through searching for information; and the quality of information found on the internet was inconsistent. I have printed part of the reply by the author because it helps to provide some background and incentive for the action that the student took during her practicum. Keith Topping responded with the following:

There are many teachers who do not have such a balanced perspective, because of limitations in their own familiarity with the electronic medium. Such teachers are likely to cling to traditional media in the classroom, while their students go web-crazy outside it. Such students are much less likely to develop skills in critical appraisal of the electronic medium. ..

So I guess my conclusion is that the situation you describe is not so much a problem, more a valuable opportunity (although some days it might not feel like that!).

As I mentioned previously the student found Topping's reply to be not only surprising but also helpful in terms of encouraging her to think about ways in which she could build the use of web resources into her own teaching practice. During her practicum experience this student integrated web resources into her social studies unit. In part she had to because there were few up to date print resources on the topic she was teaching (a unit on Nigeria). However, in order to address her concern about the use of web resources, she constructed a web page with links to relevant sites and she designed particular activities for each of these links. In this respect she provided a resource filter and structured student research in efficient and effective ways. The student also developed a lesson in which she

talked with students in her class about critically reading web resources. She explained this as follows:

We just went through examples, like how to pull out relevant information and facts and how to check those facts to make sure they are right. We had a discussion about whether the Internet is the all-knowing truth.

The work that the student did in this unit represented an important step for her - not only had she integrated technology into her teaching practice, but she had done it in ways that were grounded in a sense of good pedagogy. Her comment to me was:

It worked so well. I can't even tell you. At the start of the year I knew nothing about webpages and how to use them.

In this case the ideas developed through the ROL activity complemented other work that the student had completed as part of the language arts course. This included designing a web page and developing an understanding of 'information literacy', i.e. ways to teach students how to critically use print and electronic resources. In this example it is possible to see how the student was able to build and develop ways of integrating information technology meaningfully into her teaching practice. To bring this back to the ROL activity, in his reply to this student Keith Topping said that one of the things that he is trying to do through his research is to develop the organisational and pedagogical frameworks that would enable a wide range of students to learn computer skills in more "systematic, rigorous and effective" ways. In taking these actions the student brought theoretical and practical ideas to bear on a problem and developed a pedagogical framework for using technology in her classroom.

Vignette Two

One article that many students responded to was "Kindergarten Stories: Writing and Drawing at the Computer" (Caroff, Kiefer, & Roccograndi, 1998). The article described ways in which a teacher had used a computer as a way of assisting a group of kindergarten students to write and illustrate a class story. The seven students who participated in this forum responded to both the article and to each other's postings. In this forum each student who commented acknowledged that the article demonstrated some useful ways in which the use of computers could support children's literacy skills: it was useful for integrating writing and drawing, for editing, maintaining a story-line, broadening a child's sense of text, and for seeing writing as 'play'. What is also

interesting is that every student also expressed reservations about the use of computers with young children. They provided various reasons for this including concern about social interaction, the need to know how to use pen and paper, the fear that the computer might replace a teacher, that keyboards are too big for small children and so on. As the thread continued students agreed with each other:

As education continues to emphasise the use of technology in the classroom, I agree with Chad and Leslie that traditional methods of teaching reading and writing should not be neglected.

The statements that students made are revealing of their assumptions and values regarding educational uses of technology. These views are not surprising and in many ways quite sensible in that they are resisting adopting either side of the polarised rhetoric so often associated with technology and education. However I do think it is worth pointing out, as Burbules and Callister (2000b) do, that so called traditional methods of teaching and of writing do not get questioned in the same way as teaching practices that use computer technologies. In the comments made by students, traditional methods of teaching and of writing, whatever they may be, were accepted unquestioningly as good. This was a point that the instructor raised in her feedback to students, suggesting that what is meant by traditional needs to be delineated and challenged. She said that it is often a term used to describe transmission models of teaching. The students also seemed to be assuming that technology will somehow replace teachers and stop communication between students.

In this example I want to highlight one student's reaction because it shows how her thinking on the matter changed through bringing the ideas to her practicum context. In the ROL forum she had taken a fairly strong stance on uses of computers with young children. The other students in the forum argued for a 'balanced' approach to use of technology in the classroom - i.e., school students need to learn computer skills but they also need to learn to write with pencil and paper; computers are useful for teaching some concepts but they should not replace the instruction provided by a teacher. This student however argued that computers should not be introduced into kindergarten classrooms. Her reasons are as follows:

Despite the advantages mentioned in the article I am wary about the use of computers in classrooms. I have seen children become frustrated when using a keyboard too big for their small hands. Also, composing stories on a computer can be a difficult task for newly literate children because upper case letters on the key board don't match the lower case letters they need to complete their sentences. Further, I feel that at this age social interaction is of critical importance and is fundamental to development. Kindergarten is a time for hands on interaction with the physical world and for learning from community experiences. For these reasons I feel that kindergarten is too early to introduce computers in to the learning environment.

This student however, followed up on the ideas raised in this article by discussing it with her sponsor teacher. Through the course of her discussions, as well as observations of a kindergarten class, this student changed her perspective on the use of computers with young children. In one of the focus group discussions I asked this student whether the ROL assignment bore any relation to practice.

Jane: Did it make any sense for you in terms of your practice?

Student: It did for me. When I did the assignment it didn't. I was commenting on the articles with no background knowledge and so now what I feel I wrote on ROL is wrong or not what I would write now... My sponsor teacher's opinions were different than what I had originally written and then what I actually saw in the class was different than what I had originally thought, so I think my ideas changed.

After talking to my sponsor, I have softened my views on computers in a kindergarten class. I feel that I didn't have enough experience to draw on in my answer and responded instead by instinct.

Two things are worthy of note. First, through doing the review the student had the opportunity to articulate her ideas and values regarding the use of computers in schools and corroborate her ideas with those of her peers. Second, the student talked about this topic with her sponsor teacher and also had the opportunity to observe how her sponsor teacher used computers in her classroom. The student then used this experience to reflect on the views she had posted onto *ROL* and subsequently developed a different perspective on the matter. When I discussed this with the student she indicated that she felt a little awkward about changing her mind on an issue, particularly having committed herself in writing and in public. My response to her at the time was that I thought it was entirely appropriate to change one's mind in light of new evidence and that this is how one builds and refines theories of practice. I think that the above case is a good example

of how a student can clarify their position on a topic by bringing various perspectives and experiences to bear on the issue - the perspective taken in the article, personal values, the ideas raised by peers and sponsor teacher, observations and so on.

I think one of the key things here is that not only are connections being made between certain ideas, but that various teaching practices are opened up for public discussion. This set a tone for professional conversation and in this case the student extended the discussion by talking about the matter with her sponsor teacher. While obviously this set of connections is not dependent on the ROL forum alone, and could well have been made with any other form of resource, I think the important thing to note is that the ROL forum encouraged students to see themselves as part of a process of inquiry and to see that teaching practices and theories are always subject to refinement. Responding to the article required students to make their values explicit, and they could then check these values in light of other experiences. A key question for future action is to consider how these sort of conversations can be broadened so that more students return to the online forums and converse with the sponsor teachers about issues raised in campus based classes.

Conclusion

The above discussion demonstrates how the Reading Online assignment served as a means of extending the range of ways in which students could communicate with other professionals and their inquiries concerned with language and literacy education. Key aspects of this form of communication and inquiry were, first, the ability to be part of a professional community, one that brings together professional and academic discourses. Second, participation in the forum extended the audience and purpose for student work beyond one instructor and beyond simply gaining a grade. While the responses to student contributions were not great, particularly during the period in which the assignment took place, and while the connections that students were able to make between the activity and their future action were limited, nevertheless the cases in which these connections did take place demonstrate the value of such connections for enabling students to articulate their own theories of practice. The key for the next phase of action research would be to develop ways to extend these type of connections.

CHAPTER SEVEN

THE HYPERSTUDIO MATH PROJECT

Introduction

The purpose of the Hyperstudio Math project was to consider whether and how a tool for multimedia design could be used to extend students' understanding of pedagogical practices associated with mathematics and of ways in which computer technology could be integrated in classroom practice in schools. The conditions underpinning the learning activity in this case included working in pairs; direct relevance to teaching practice; the integration of various modes for communication; and a public audience. The key arguments made on the basis of the study are that design process was important in extending student teachers' understanding of the variety of ways - visual and symbolic - in which mathematical concepts can be represented. Working in collaborative pairs supported the process of design, experimentation and creativity. However at times the 'bells and whistles' associated with a multimedia design tool overshadowed the mathematical purpose of the activity. Furthermore, while students could see many possible links between their work in the project and their practicum context few were able to build the use of such design tools into their teaching practice.

Context, Text and Technology

As the name suggests, the Hyperstudio Math Project was part of the Mathematics Education course. Integral to this year-long course are activities that assist student teachers to develop an understanding of mathematical concepts and methods for teaching and learning those concepts in elementary school settings. In this project student teachers used the multi-media software program 'Hyperstudio' to design a presentation that had as its purpose explaining, illustrating and teaching a set of mathematical concepts to school students.

The technology focus in this project was very different from the other two projects reported in this thesis. The focus on 'design' and the creation of a teaching resource provides an interesting contrast with the other two projects, which were both concerned with communication and the critique of ideas. Nevertheless the same framework for analysis has been employed to consider the data that emerged from this project. This will not only be a comparison of the type of technology and texts produced, but also of the process of inquiry that students engaged in to complete a Hyperstudio presentation. The Hyperstudio stacks that students produced constitute one set of data. This data will be considered alongside comments made by students in a written evaluation of the process and in focus group sessions, as well as observations made by the instructor and myself. Again a key assumption underpinning the analysis is that the social and technological are inter-related. Thus my concern will be to identify the social relations and connections that developed through the design process and as a consequence of completing the Hyperstudio task.

The Hyperstudio Project developed from a chance meeting that I had with Carole Saundry, a teacher in the Richmond School District. Carole was a technology and resource teacher in an elementary school, and at the time of meeting I was searching for ways to better align uses of technology in the CITE program with uses of technology in schools. From this initial meeting, Carole and I met on numerous occasions to talk about the approach to teaching with technology that she had used in her school. One program that Carole used extensively was Hyperstudio. Hyperstudio is a multi-media design tool that provides the means to communicate and represent ideas using one or a combination of text, graphics, sound and animation. The literacy practices associated with using Hyperstudio are not dissimilar to those of the World Wide Web. Both are 'hypertextual' in nature and integrate a variety of modes for communicating. A Hyperstudio 'stack' is a collection of linked 'pages' or 'slides' on a computer.

Hyperstudio has been created for use in schools and while it has an extensive array of design features, it has a structure and fixed set of design options that make it relatively easy to learn. Given our intent to experiment with software that student teachers could

use as part of their own teaching practice in schools, Hyperstudio seemed like a good option. Other advantages of this software included the following:

- Hyperstudio was relatively cheap and ubiquitous, although unfortunately only one of the practicum schools had this software.
- It had broad appeal to a range of users.
- It aligned with a technology focus on design and new literacies;
- The program was available in the lab at UBC.
- Using Hyperstudio consolidated our partnership link with Carole Saundry in the Richmond School District.

Heather, the mathematics education instructor at UBC, expressed an interest in using Hyperstudio in the course that she was teaching. Heather, Carole and I met on three occasions to talk about how this might be possible. At these meetings one of our main concerns was to consider how using a program like Hyperstudio might enhance student teachers' understanding of mathematics, how children learn mathematics and how to teach mathematics. Our thinking focussed on how a variety of media - symbols, pictures, words, colour, animation and sound - could be used to represent, explain and help teach a mathematical concept. At the same time, we wanted our use of Hyperstudio to provide a more general model for ways in which students might integrate technology and the literacy practices associated with multi-media technology into their teaching practice in schools. In this sense it was extremely useful to have the three of us planning the project as we each brought a particular area of expertise to the table in relation to our understanding of mathematics, teacher education, communication, the school context and technology. So too, discussions with Heather during and after the activity have been extremely valuable by way of assisting me to understand issues related to the representation and learning of mathematical concepts.

The Task

The task that students were required to do was as follows:

Your task is to design a stack that explains your choice of mathematical content to the audience of your choice. ... The important thing is to focus on the purpose...the math teaching, and using technology for instructional purposes and as a communicative tool.

Students were asked to incorporate into their stack the following: a real life context; a flow from simple to complex, and from concrete to symbolic representations; and an interactive component. Some technical requirements were also set. Students were to create no more than ten slides and to link their cards. Students were also encouraged to use the multi-media tools purposefully rather than gratuitously. A final part of the assignment was to write a note to accompany the stack that explained features of the text and context and the processes that students went through to develop their stack.

Students worked in pairs to do this assignment. This was both pragmatic – there were only twenty computers in the lab - and pedagogical – we wanted this to be a collaborative activity. Over a four week period, two hours per week of lab time was provided to do this task. Students also had access to the lab at other times if they wished to use the Hyperstudio program.

Key aspects of the inquiry included: developing an understanding of how others might learn a mathematical concept; researching and understanding a math concept; communicating ideas using a multimedia tool and developing the technical competence to do this; working with a partner; transforming ideas to suit a particular audience; presenting ideas to an audience and reflecting on the process and purpose of this task. Students had already spent some time in schools and knew the class and general topic areas they would be teaching during their practicum. Thus, in designing a Hyperstudio project, most students chose a mathematical concept and method of presentation relevant to their future practicum experience.

The Mathematics Education course ran over two terms and students began the Hyperstudio Math Project at the start of the second term. Carole provided an initial 45 minute introduction to Hyperstudio. The student teachers were not familiar with Hyperstudio software prior to this workshop. In the workshop Carole explained the basics of the program, demonstrated some tools and provided students with an opportunity to practice using some of the tools. Following the workshop, Heather introduced students to the assignment and its requirements. From this point, work on the Hyperstudio Math project took off, quite literally. I have to admit I was amazed by the ways in which students engaged in the project. They would come to the lab sessions early and leave late - there was a positive 'buzz' in the lab that I had not experienced before. In the remaining sections of this case study I will describe and account for the nature of this engagement.

A Design Tool

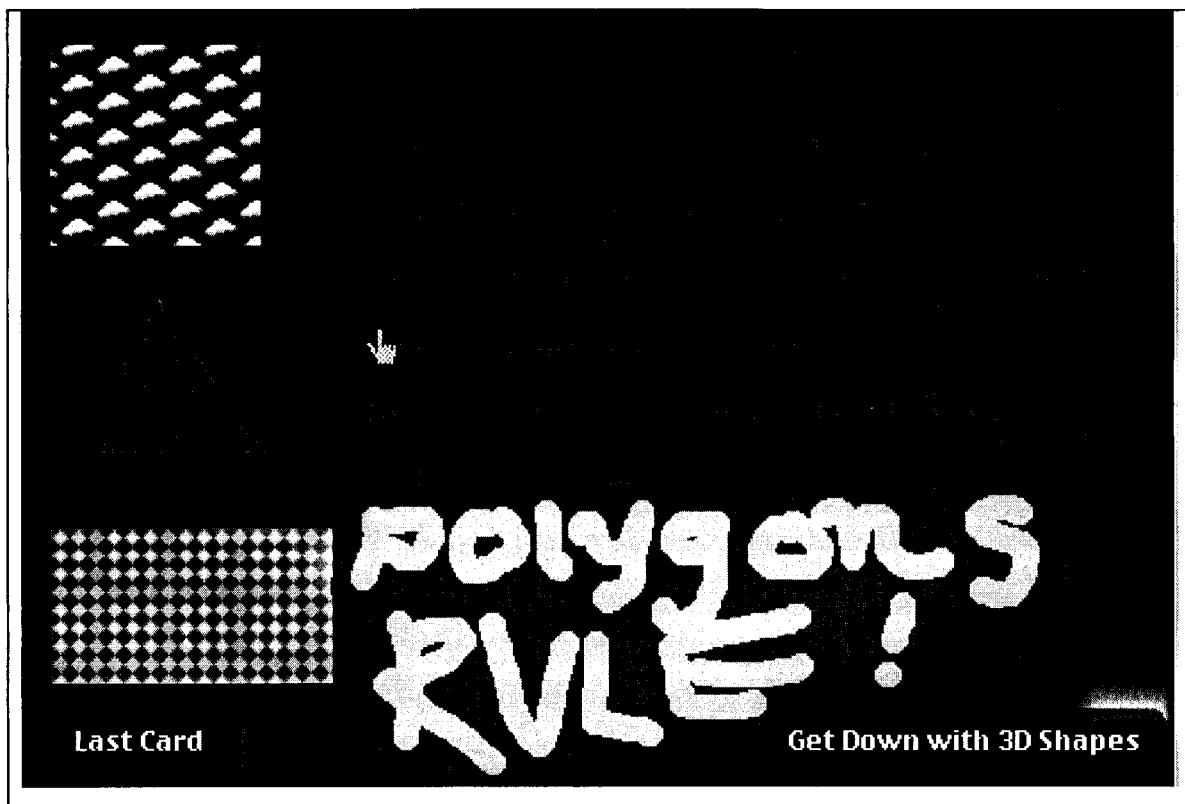
The Hyperstudio Math project was very different from the other two projects described in the thesis. In the other two projects the mode for communicating was predominantly written and the actions central to the activities were primarily concerned with critique and response to others' ideas. The use of the Hyperstudio program, on the other hand, was concerned with design, that is bringing together a range of media in order to communicate an idea, and in this case, to explain and illustrate a mathematical concept. As discussed in Chapter 2, Kress (1998) uses the term 'design' to describe the orchestration required to produce a multi-media text. It is a term that he uses in light of changing patterns of communication over the last three decades. Kress argues that these changing patterns are characterised by a shift from verbal to visual modes of representation, the development of new technologies and the emergence of the 'screen' as the 'new space of representation' (p.72). According to Kress, the linguistic and semiotic detail of this shift include the following:

- Written text is part of a visual unit. For example, considerable attention is paid to layout, spacing, size, colour and shape of letters. Further, the use of 'text blocks' - their nature and location, are part of the visual meaning.
- Images are increasingly used to carry meaning, and not simply illustrate the meaning of written text.
- Written language is moving closer to speech.

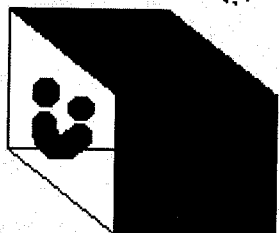
- There is a strong interaction between visual and verbal modes of representation. Here Kress is suggesting that language and image do not do the same job, they are not simply translatable, nor do they co-exist. Rather the meaning is in the interaction between language and image.

These ideas dovetail with symbolic and iconographic ways of communicating mathematical ideas. Visualisation is also a key part of the processes associated with abstraction in mathematical thinking (Kelleher, 2000). The sample of student work from the Hyperstudio Math project below (Figure 1) illustrates some of these points. The intent of this project was to describe and explain polygons.

Figure 1: Examples from a Hyperstudio Stack



FACES



Properties of 3D objects include faces.

Faces are defined as the flat surface of a 3D object.

The highlighted portion is one face of the 3D object. Do you know how many faces there are?

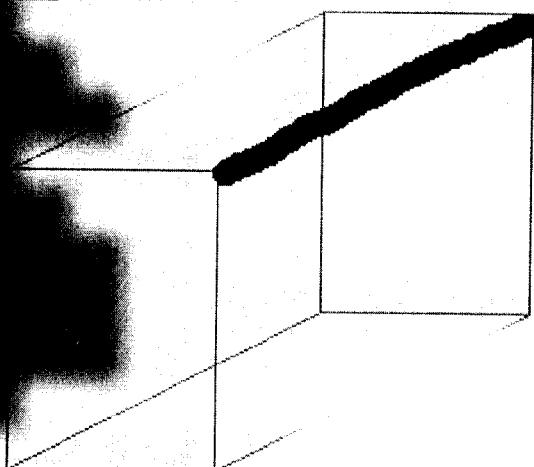
[Back to 3D Shapes](#)

[Edges](#)

Livin

On The

EDGE



Another feature of a 3D object are edges.

Edges are defines as a line segment where two faces of a 3D figure meet.

The blue line represents an edge.

[Last Card](#)

[Vertices](#)

While, obviously, sound and movement are lost when presented on paper in this way, what this set of slides demonstrates is how one group of students sought to use visual and

verbal modes in order to communicate their ideas. In this case the communicative purpose of the text was to explain a mathematical concept (polygons) to an intended audience of, in the first instance, school students (grade 5), and in the second instance, peers and instructors. Explaining ideas using text and graphics is not new (Kress, 1998), particularly when the audience is under 12 years old. Moreover, representing and explaining certain mathematical ideas such as geometric shapes necessarily requires bringing together graphics and text (Lemke, 1998). Using a program like Hyperstudio brings the interaction between text and graphics into sharp relief. In the above example, written text is stripped to a bare minimum and does not make sense without the pictures; the text is part of the visual effect through the use of, for example, colour and the graffiti style lettering; and the text is conversational in tone with short sentences and the use of words such as 'cool'.

These representational effects reflect both the technological possibilities associated with the software, as well as a social purpose. The Hyperstudio technology enables and/or requires a particular style of communicating - the emphasis when working with the Hyperstudio program is on visual presentation - creating and manipulating images and the visual layout of the slides, with limited options for presenting written text, sound and animation. At the same time, the social context enables or requires a particular style of communicating. In this case the student teachers were creating a presentation for an audience of Grade Five students on geometry. This social purpose can also be drawn on to understand the ways in which text and images were built into the text. My point is that the social and technological are interdependent and the process of design and inquiry reflects this interdependence. In this case however, most students' relative inexperience in designing multi-media presentations and using the Hyperstudio program meant that initially at least the technological tools and the literacy practices associated with these tools played a very visible and noticeable part of the inquiry process. It is to this process that I now turn.

The Nature of Connections - People, Ideas, Resources and Experiences

Given the above discussion a line of thought developed in this section of the case study is that those actions associated with the design of Hyperstudio presentation were integral to the processes of inquiry associated with this task. The main activity was thus one of transforming the ways in which resources and ideas could be represented in order to create a new teaching resource. Thus, there is a set of teaching and learning practices surrounding the process of design, specifically the ways in which students negotiated with peers to develop and present their ideas. More broadly, there is a set of teaching and learning practices associated with the integration of this project into the mathematics course. I am thinking particularly here of the roles assumed by Heather, Carole and myself and how our roles with respect to conceptualising and implementing the project supported the conduct of the student inquiry. Below I will discuss some of the processes of inquiry and make some comments about whether and how it extended student teachers' levels of engagement in relation to their understanding of how to teach mathematics and of the educational potential associated with multi-media design.

Resources, Information and Ideas

Students drew on various sets of resources and ideas in order to complete the Hyperstudio Math project. These resources included ideas and concepts relevant to the content area and to teaching this content, as well as the knowledge and technical information regarding how to use Hyperstudio and design a multi-media presentation. The topics that students chose to explain and teach using Hyperstudio included patterns, polygons, money, tessellations, motion geometry, perimeter, integers, timelines and distance. These topics can be grouped according to the British Columbia curriculum guidelines: number and operations, patterns, relations and functions and shape and measurement. To understand the math content and how it could be taught students drew on various sources such as the provincial Instructional Resource Package (BC Ministry of Education, 2001) for elementary mathematics, math textbooks, web resources, print resources, ideas from peers and the instructor, as well as their own existing ideas and understandings about the topic. Some groups did considerable research. For example, the group that explained aspects of motion geometry through the process of quilting gathered information from web-sites, text books, pattern books, the IRP and other resources provided by the

instructor. Other groups drew more on their existing knowledge of the subject and concentrated on how that topic could be presented.

The Software as a Resource

Given the nature of this project with its focus on design, students needed some facility with the Hyperstudio program tools. This included using and integrating various media, linking slides and building in interactive components. More particularly, this included downloading files, importing graphics, inserting backgrounds, animations and sound, and presenting visual and textual images. The software tools and the knowledge of how to use those tools thus constituted an important set of resources. Some of the social practices associated with learning how to use the tools will be discussed in the next section. Here I want to focus specifically on student reactions to the technical and representational capabilities of the tool. The ways in which the students used the technological resources in many ways represented a balance between what the students wanted to present, the capabilities and limitations of the program, their own skill and creativity in using the Hyperstudio tools and the time available to do the assignment. For some students the process of finding this balance enabled them to exceed initial expectations.

When Jen and I decided to do patterns for her Kindergarten class we thought we would be limited to picture or number patterns. However once we got comfortable we began to experiment and found other ways to show patterns.

Many students found that the specific Hyperstudio program tools enabled them, in the first instance at any rate, to be creative. At the same time many students found the technical limitations of the program to be a frustration.

Some of the problems we faced within this program were the fact that once you had typed text material, it was more or less written in stone... This became a pain throughout the whole development of the Hyperstudio project.

We became frustrated with the limited "undo" capabilities of the program and had to recreate some cards several times.

A number of students were also critical of the interactive features of the Hyperstudio program, if they were to be used as a teaching tool. For example the program has a multiple choice testing function which can be incorporated into the slides.

Hyperstudio does not record the number of attempts a student makes before arriving at the correct answer, which is frustrating from an assessment point of view.

The testing function is set up in such a way that as long as you click on the right answer you will eventually score a perfect mark. The computer doesn't note how many wrong answers you entered before getting the right answer. In addition, you could only have multiple choice type testing questions. It was impossible to type in a text answer and have the computer know if it was right or wrong.

One student with considerable technological and design expertise found the Hyperstudio program to be limited to the point where he asked to do an alternative to the assignment.

His comment was:

Basically I haven't been able to figure out the potential of Hyperstudio for demonstrating a math concept better than what can be done already without technology... The one benefit would have been animation and digital manipulation of objects [for transformational geometry]. This would help out those students who, like me, have trouble visualising the motions. However, this seems to be impossible with Hyperstudio.

This student raised an important point concerning the use of computers, and in this case whether the Hyperstudio software was an appropriate means to demonstrate a mathematical concept. His second point was that Hyperstudio could be useful for some concepts but when compared to more sophisticated multi-media software it was simplistic and limited. Certainly these arguments forced both Heather and I to question our reasons for using the technology - were we simply using the technology because we felt that we had to, were we manufacturing a purpose for its use that did little by way of reaching the mathematical and pedagogical goals of the course? In thinking about this we acknowledged that every communicative means has its limitations and we acknowledged that this was one means of demonstrating a concept among many. Given the experimental nature of this work and the varied purposes that this task served, we were interested in identifying ways in which students might work around these constraints to create some new practices and new forms of representation. Indeed, many students did find creative ways around the limitations of the program.

We again felt limited by the graphics available and we decided to experiment with the draw tool, creating our own graphics. We were excited by our first success and felt that it gave the stack a 'folksy' aesthetic that we really liked. We also gradually began to use icons to represent our buttons. The transitions between

cards became a way to reinforce the idea of pattern. We used bars, blocks, diamonds and more.

It was frustrating at first, but we managed to find all the images we needed... and we didn't even ask for help! We just fiddled around with the edit buttons, saved the images on the hard drive and then copied and pasted it on to our stack! Simple as pie? Not at first, but we managed!

These comments demonstrate some of the communicative possibilities and limitations of the Hyperstudio program. They also indicate that learning how to deploy and manipulate the resources and tools was an important part of student engagement in this project. One student made the comment that:

One of the things I found so useful about this assignment was being able to look at the visible progression of learning from beginning to end.

When doing the final review of their stack the two students in this group noticed that each slide in the set demonstrated an increased degree of technical proficiency and sophistication. Their stack in a sense provided documentary evidence of what they had learnt about Hyperstudio tools and multi-media design over a four week period. For many of the students, the development of skills associated with Hyperstudio, did in fact represent a sophisticated use of multi-media. Design skills in manipulating the Hyperstudio resources were the key. I will consider the pedagogical practices associated with the deployment of these resources and the degree to which the technical resources could be used to complement or augment the math resources and student teachers' understanding of mathematical concepts, and ways in which those concepts can be taught and learnt.

Connections Between People - Pedagogical Relations

Two related parts of pedagogical roles and relations will be analysed in this case study. One part is the actual doing of the task - that is how students worked together to design and construct a stack. The other part is the set of teaching and learning activities that existed alongside the design of the stack. I am thinking here in particular of the roles taken on by Heather, Carole and myself and how we worked together and with students to design and implement a curricular and communicative practice that explored a way of integrating technology into teacher education coursework. Here the pedagogical relations were structured around working with a computer as a design tool. Thus most interaction

took place in a lab setting and involved face-to-face communication. This is quite different from the other two projects that focussed on using web-based technology as a medium for communication in ways independent of time and place. Thus the types of social interaction between participants in this task were very different from the other two projects. In this section of the chapter I will outline the ways that the activity helped to connect people and the part these connections played in establishing teaching and learning practices.

Connections Between Peers - a Process of Design and Construction

As mentioned previously, most students worked in pairs to design and develop their Hyperstudio presentation. Working in pairs became a central element of the pedagogical practices within the design and inquiry process. Computers are often considered to be tools that serve to cut people off from communicating with each other. Yet in this case they actually provided the working space for joint action by students.

Not all students chose to work in pairs; two students worked on their own. Furthermore, the ways of working in a partnership varied. Some pairs divided up the task, did their own piece of the presentation and then joined these at the end. However, for most of the paired groupings, one computer provided not only the construction space for their text, but also the opportunity to, in a very literal way, jointly construct the text. It was quite common to see one person using the keyboard and the other the mouse, or to see that students alternated their use of the keyboard and mouse. In observing pairs at work I was reminded of the Cyborg image that Haraway (1991) and others have talked about. The difference in this case was that two people were connected not just to the computer but to each other through the use of the screen as a shared design space. Using the computer in this way actually encouraged communication between students. The following comments provide a flavour of the ways in which students described the process of working with a peer on this project.

We got in the zone working together and we didn't do anything on paper, no preparation on paper. All our writing was on the computer. We didn't know what the next card was going to look like until we had finished the card. And to have the support there too. Everytime we ran into problems - aahhh - I would lose patience and Karla would come in and go OK, or vice versa.

We were swapping back and forth (using keyboard and mouse) and we found that it went faster too, because we spent like the one day in the lab - we were there 8 hours... But anyway it is funny how fast time flies when you are doing that kind of thing. We were into it and not even minding being there.

Instead of discouraging interpersonal communication, our tech work actually seems to facilitate it because we needed to come together to share ideas to do the assignment.

Furthermore, much of the learning about the capabilities of the software came through a process of trial and error.

I wonder if something could be taken from that, because I noticed people found so many different things through just trial and error and the creativity of experimentation.

Here I would suggest that the process of working in pairs coupled with the nature of the software enhanced experimentation and creativity. These comments were certainly corroborated by the observations that Heather and I made. As I have previously indicated I was continually amazed by the ways that the students worked together both within their pairings and with other groups of students. The experimental action worked in two ways - students would have a sense of what they wanted to produce and then experiment with tools to try and work out a way of doing this, or they would experiment with the tools and on the basis of knowing their capabilities apply them to suit the content and purpose. Heather commented that the design space of the screen enabled students to work together in very different ways and in many cases in much more productive ways than if they were planning a unit on paper.

Given this I would argue that one of the key sites for teaching and learning existed in the collaborative action between students as they worked on the design of their math presentation. The collaborative action went beyond just the pairs, as the following comment by one student demonstrates:

The other fun thing was looking at other people's, saying - oh - did you see what they have done. We would have a look and they would say, oh I just got that from the desktop or clip art or whatever. And then they would tell you and you would go back and try something like that. We had a progression like that. At the beginning quite plain and at the end more advanced and it was all because of the ideas we got from others.

In this respect there was considerable exchange of ideas amongst those in the class. The key thing to note is that this student saw this as a progression, in other words some building on and extension to existing ideas.

Instructional Roles

The instructional roles played by Heather, Carole and myself were a central and obvious part of the social activity associated with this project. We worked together as a team to both plan the project and assist students in their design work. The actual structure of the assignment and the purposes that it served reflected the different ideas that each of us brought to the table. Likewise during the lab sessions each of us played a different role. Carole's role was invaluable both technically and symbolically. She provided an inspirational start through her demonstration of how to use the software. The comments made by two students attest to this:

The session where Carole came in was wonderful. She is a very good teacher of technology. I felt that after the session with Carole I could start working on the assignment.

I think part of the atmosphere, that energy in the class was shaped by Carole's presentation. She gave us back up from the literature and she would get us to stop and pay attention. She was really good and it made all the difference.

As well, the fact that Heather, Carole and I were seen to be working together represented a partnership between schools and the university that added a degree of credibility to what we were doing. Carole's input also enabled students to begin to envisage ways in which they could incorporate ICT into their own teaching in schools.

In completing the assignment, most of the students developed considerable skills in using Hyperstudio tools. Thus the students, as Heather and I both acknowledged, developed technical skills that surpassed our own. The pedagogical role that Heather and I were able to play in the lab session was far more oriented to talking with students about ways of conceptualising and communicating ideas, and indeed learning from the students about ways of using Hyperstudio tools. During the lab session Heather sought to create opportunities for students to share their knowledge and skills with the whole group. As well, Heather provided the main links between the assignment requirements, the lab session and the rest of the coursework.

Another key action that Heather took was to organise a public 'showing' of student projects. This was done in recognition of the level of student engagement and interest in the activity and their sense of pride in their projects. An invitation to this showing was extended to a number of graduate students, faculty and school teachers. This both created an audience for student work as well as an opportunity to talk to others in the Faculty about the technology initiatives taking place in the CITE program. Furthermore, this session provided students with an opportunity to review each other's projects. At this event students demonstrated their projects to their peers and others in the audience, and many of the people who attended worked through the slides and tasks created by the students. Readers of each stack were asked to complete evaluation forms by way of providing students with feedback on their projects. This audience and activity, in a way that is not dissimilar to the other projects described in the thesis, had the effect of creating a purpose for the assignment beyond just submitting a presentation to an instructor for a grade. Perhaps the acid test for the students' projects would have been to present them to the audience for whom they were written - students in elementary schools. Unfortunately we were unable to organise this but the question of how the project work linked to school based practices will be taken up when I consider the ways this project enabled students to make connections between campus and practicum.

The above discussion has attempted to convey the importance of the collaborative action that underpinned the design process. While collaboration is almost a cliché in most educational circles, I think its importance here was in the way in which a process of joint action enabled students to generate and develop the skills and ideas required to complete the project. It is important to note that the collaboration and negotiation existed not just amongst the students but also included the ways in which Heather, Carole and I worked with students and each other to both teach and learn the technology, the mathematics and the ways of communicating mathematical ideas. This collaborative action, which was augmented by the public presentation of student work, provided the basis for formative and summative evaluation of work by peers, instructors and interested outsiders. Students were also able to think about how the processes associated with collaboration might

inform the ways in which they taught both mathematics and technology in a school setting. It is these connections that I examine in the next section.

Substance of Connections

In this section my intent is to consider the ways in which the work associated with the Hyperstudio project extended the connections that students were able to make between the ideas, concepts and practices that were related to this project and the teacher education program. Some of the connections were intended project outcomes, others emerged serendipitously; some connections were tenuous, others were more substantive. The two main points for connection that I will elaborate on in this section are those connections that are internal to the course, particularly the degree to which using this technology and drawing together a range of representational resources assisted students to understand and explain a mathematical concept. The second connection is the one between the campus based activity and students' school and practicum experience.

Mathematical Connections/Connections Internal to the Course

Connections between Hyperstudio tools, communication modes and mathematics have been mentioned previously. Here I want to consider these connections in more detail, particularly the relationship between the social and communicative processes, the actual text that was produced and mathematical understanding. Here there are some positive outcomes as well as some concerns. Several students made the comment that their own understanding of mathematics developed through designing the Hyperstudio presentation. For example the two students who designed a motion geometry presentation made the following comments:

I found it a valuable exercise to have to modify what I wanted to do with the program... I also believe that I learned more about the subject because of the way I had to illustrate the concept. For example, Dale and I wanted to import a graphic of a 3-D object that would be animated and rotate, so that the viewer could see how shapes could be flipped and turned to produce different patterns. But because we weren't able to do this, it forced us to do everything by hand, and thus forced us to actually think the flips and turns through rather than have a graphic do it for us.

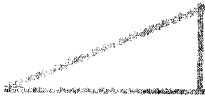
I have a lot of problems with spatial geometry. What I found helpful was to manipulate the graphics so that a picture could tell how it was manipulated without so many words. I now don't think I will ever forget what a slide or a flip is.

Figure Two shows two examples from the presentation prepared by these students.

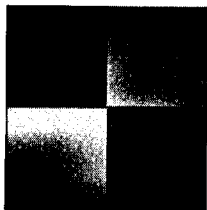
Figure 2: Geometry

shapes used by quilters are the triangle and square

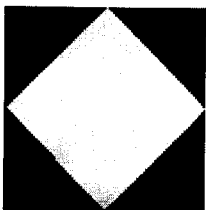
There are three types of triangles:

Isosceles:		two equal sides two congruent angles
Scalene:		no equal sides no congruent angles
Equilateral:		three equal sides three congruent angles

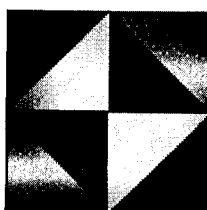
Block # 1



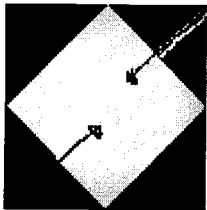
Block #2



Block # 3

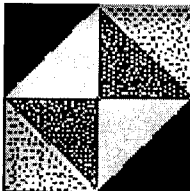


Imagine sliding Block 2 over top of Block 1. What would it look like?



Will the colours change?

Right! Now pretend that the block is made of paper. Fold (flip) the top right (blue) corner into the middle, and fold the bottom left (blue) corner into the middle.



Great! The blue corners flipped into the middle, covering the yellow and revealing the pink pattern.

next step

Heather also commented on the connection between the sequential and spatial representation of ideas integral to Hyperstudio and learning and teaching mathematical concepts:

I certainly didn't appreciate until I saw them do it the potential of the cards in terms of sequencing thinking about prerequisite learning and the potential of students thinking about the visual impact. I thought that was really powerful.

These ideas resonate with a comment made by Lemke (1998): "Many mathematical concepts that are confusing or resist easy explanation and learning in natural language alone become far clearer with visual representations and manipulatives combined with natural language" (p. 292).

The Hyperstudio project required students to integrate and connect their technical, mathematical and communicative skills and knowledge. Not surprisingly the degree of integration and the balance between technical, communicative and mathematical effects varied from project to project. In some cases the explanation and the representation of the topic was enhanced by various modes of communication. This was especially the case for topics such as shapes, geometry, pattern and problem solving. In some cases too, as students' proficiency with the technology developed it became a more taken for granted and less noticed part of the process (Bruce, 1997). In these cases the conversation between students was less focussed on the technology per se and more on the communication of mathematical ideas. In other cases the connections between modes and topic were not as strong or appeared forced or unnecessary. For example, one student who did her assignment on money readily admitted that this topic did not lend itself to this sort of presentation. Further, in some projects the technical effects overshadowed the mathematical component. It is very easy using programs such as Hyperstudio to incorporate a large range of 'special' effects that do not always complement the purpose of the text. Heather also expressed concern about the level of mathematical understanding demonstrated in some of the projects.

I think there was variation in the degree to which people attacked the mathematics and thinking about what is appropriate for kids - what they need to learn and the depth they need to learn... If you looked at it just for the math part, for half of them you would be unimpressed - because it is either at a superficial level or it is not really engaging or there are errors there.

While there are many reasons why some students' projects did not display clear or engaging mathematical knowledge, and I could only speculate on these, I do think it fair to say that in some cases the focus on the social and technological overshadowed the mathematical intent of the project. This problem ties in with the varied purposes that the assignment served and the degree to which those purposes were corroborative. This will be taken up in the final section of the chapter.

Another point worth noting was the way in which many of the students sought to connect or integrate their mathematical understanding with other subject areas or activities. Part of this obviously related to the assignment requirement, which was to connect the math concepts to the everyday, but another part stemmed from the way that the media could be used. For example the group that did patterns found that they were able to incorporate music and movement into their presentation once they found out the capabilities of the program. Another group doing patterns built music, art, textiles and poetry into their presentation (Figure 3).

Figure 3: Integrating Music and Poetry into the Math Stack

Find the last word in each line and write it in the box below.

Snap!

She was opening up her umbrella,
 She thought it was going to rain,
 When we all heard a snap
 Like the clap of a trap
 And we never have seen her again.

-- Shel Silverstein

→
↩

Listen to the poem and write the last word in each of the lines in the boxes below.

Snap!

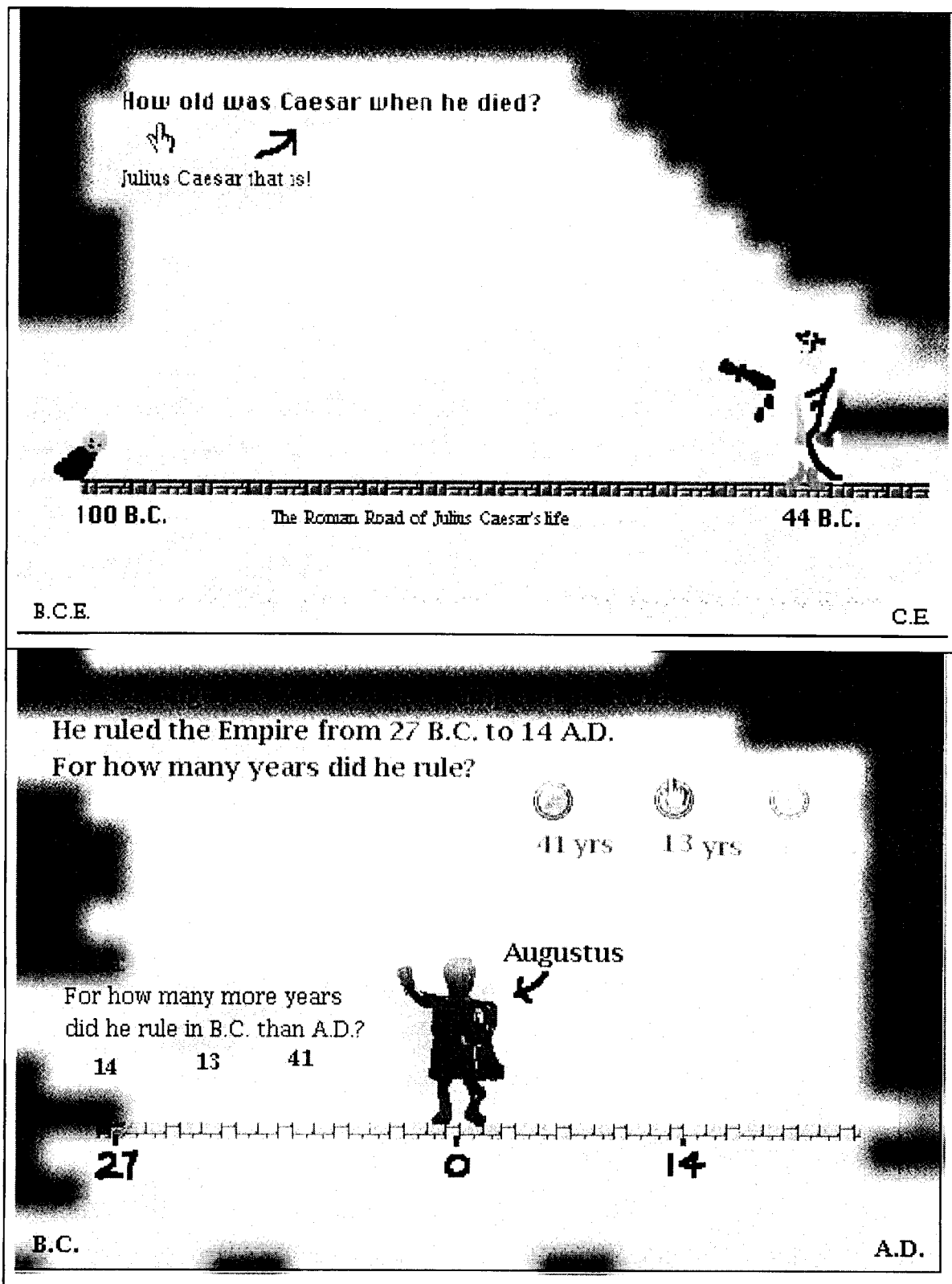
She was opening up her umbrella,
 She thought it was going to rain,
 When we all heard a snap
 Like the clap of a trap
 And we never have seen her again.

→
↩

One student linked the mathematics to units she was preparing in Social Studies (Figure 4):

When I set out to do the Hyperstudio project I was thinking a lot about Ancient Rome and timelines and how students might figure out the time spans between BC and AD.

Figure 4: Math and History



By way of follow up this student made the following comment that showed how her interest in the area had been extended.

I am now also intrigued by calendars - where did Year 0 come from (i.e. who initiated it?). When was it first implemented? Did early civilisations use the concept of years? How can I tie this into math and measuring time?

A further connections was made by the Language Arts instructor. When she saw what the students were doing for their projects she was able to talk about this as one example of the changing literacy practices associated with multi-media technology.

Connections Between Campus and School

It is worth keeping in mind that the Hyperstudio Math project served a number of purposes. In the first instance its purpose was to extend student teachers' understanding of ways of teaching mathematics and ways in which students learn mathematics. A subsidiary purpose was to extend student teachers' understanding of the ways in which technology can be integrated into teaching practice in schools. The task, in this respect, had a very practical bent, both mathematically and technologically. It was designed to be relevant to the school context - the math content was related to what student teachers were teaching during their practicum experience and Hyperstudio is a software program designed for use in schools. Whether students explicitly and deliberately connected the ideas developed through the project to their practicum and other teaching experiences is difficult to determine empirically. Nevertheless, some examples provide a degree of insight into student thinking and action on this topic. Given the focus on technology in this research, I will primarily discuss those connections related to technology rather than mathematics.

The Hyperstudio program provided an obvious point for students to see a connection between the campus assignment and classroom use. Students were able to see that this program had application in schools, as per Carole's demonstration. As well, students had created a resource that could potentially be used to explain and assist school students to understand a concept. Many of them were excited about the possibilities of using this

program during their practicum. Unfortunately only one school had the Hyperstudio program on their school computers. I had indicated to students that this may be the case and hoped that students would be able to transfer the general design skills they had accrued to other graphics or multi-media programs that may be available in their schools. The naiveté of this became apparent when I talked to students and realised their expectations.

I sometimes wondered about the practicality of this assignment. My practicum school does not have Hyperstudio and so I will not be able to use this stack with my students.

I think Hyperstudio could be a real asset in teaching mathematics. I feel sad that I will not be able to use this program on my practicum since our school does not have Hyperstudio. It may be an idea for next year's students to have them use the program that they have in their practicum schools.

Then we found out that our school does not have Hyperstudio, nor do they have the capacity to have such a program. Disappointment set in.

Thus most students were unable to use the resource they had created, but perhaps more importantly, they were unable to use the program as a design tool for students in the classes they were teaching. The above comments raise questions about the ways in which software and curricula practices that are part of campus-based work can be or should be aligned with the curricula practices and software in schools. Of course the degree to which campus-based work aligns with school practices is an issue in teacher education programs in general. What complicates the technology agenda is the specificity of software knowledge, in this case Hyperstudio. While the Hyperstudio project did enable students to develop confidence in using multimedia technology, there appeared little opportunity to capitalise on this during the practicum. While most of the practicum schools did have other graphics or multimedia software on their computers, students either did not have the time to learn how to use these during the practicum and/or they did not perceive that their skills were in some ways generic and transferable.

The above point poses a difficult challenge for the agenda seeking to educate student teachers to use technology as part of their own teaching practice. If the technology skills learnt on campus are not to some degree generic then the efforts to link campus-based technology with school-based technology are doomed to fail. It is highly likely that there

will be considerable variety in the type of software and hardware between and among schools and universities. This is not to suggest that the process of teaching technology skills in a generic way is easy, nor is it simple to transfer skills from one program to another. Yet one of the areas for future research stemming from this project could be to examine ways of building a generic set of skills. This might include, for example, an opportunity to learn a second type of multimedia program with less instruction than provided for the first program. An additional part of this would be developing ways of making explicit the nature of the generic skills.

In the cases where students were able to use Hyperstudio during the practicum some interesting transformations took place. Two student teachers had the opportunity to integrate Hyperstudio into their own teaching practice. Students in their classes created presentations. One student commented on what she saw as the value of learning how to use Hyperstudio on campus:

It was very practical too. Some people mentioned that they didn't have Hyperstudio in their schools and I thought they should be able to use whatever program is available in the school. Because that gave it for me - because I was able to use it in my school - that made it more meaningful for me.

This same student made the following comment about the value of Hyperstudio in her own classroom.

The students are enjoying the opportunity to explore this software. I have noticed them taking the time to make exceptional final products, they are exceeding all the project's criteria. The most beneficial aspect of hyperstudio is when the students communicate their knowledge of what is going on in class with graphics, animation, text and sound to create their own multi-media presentation. Through this process is where the real learning takes place.

The experience assisted her to articulate something about her own position as a teacher in a classroom:

One thing I learned from Carol and Jane is that I don't need to claim to be an expert to teach a lesson in the computer lab. I can share what I know with my students and they will also share their knowledge with each other, which is the truest sense of a community of learners.

As mentioned in the literature, one of the reasons why student teachers do not typically integrate technology into their teaching practice in schools is because many of the

teachers with whom they are working do not use ICT in their own teaching practice in a consistent or integrated fashion (Wild, 1996). The same was true for these two students: they were working with sponsor teachers who, while supportive of the student teachers' initiatives, did not have particular expertise with computers or the Hyperstudio program. These two student teachers therefore had to develop their ideas and take some risks on their own. Interestingly, the use that students made of this program had important repercussions within their school. These students were seen as having some technological capital, a commodity that is highly valued in school settings. They were asked to share this with other members of staff at the school. Thus, for example, they demonstrated ways of using Hyperstudio to other teachers at a staff meeting. This proved to be a connection between campus and school that had implications for the student teachers' position within the school. Their expertise was recognised, their campus-based learning was validated and they were able to contribute to the professional learning of the teachers with whom they were working. In the Teleapprenticeship study, Clift et al. (2001) also noted that there were occasions in which student teachers taught teachers how to use certain technological tools during their practicum experience. Clift et al. advocate that opportunities for this form of exchange be built more explicitly into program designs. I agree with their suggestion, particularly given that so often the knowledge and skills that student teachers possess go unrecognised during the practicum (Mitchell, 1996).

The connections that students were able to make between the campus and school work were not only based on the presence or absence of software in a school. Other students made connections based on their understanding of ways in which children learn. For instance, one student made the following comment:

We felt that if a student could see how we manipulated shapes they would understand.

In saying this the student was able to connect an approach to teaching to the means by which students might learn. Another group of students made a similar connection between teaching strategies and ways of learning.

We wouldn't present this project to students as a way of learning about pattern, but if we used Hyperstudio and said come up with a card stack that shows patterns and they invented a stack themselves, then that would be a useful way to learn about pattern.

One thing that is worth noting is the fact that many of the students included samples of their Hyperstudio projects in the professional portfolios that they prepared both as part of coursework and for interviews. Certainly the students saw that some technological knowledge was valuable in the job market. In this sense students' knowledge of Hyperstudio was an exemplar of more general technological skills and competencies. The connection between campus and work in this respect was a very pragmatic one related to professional employment prospects.

Multiple Purposes and Multiple Connections - Some Questions

Perhaps one of the key teaching issues that has emerged through both the discussions I have had with Heather, and through the process of analysis presented above relates to the varied purposes that this assignment served. These purposes, both explicit and implicit, intended and unintended, included the following: learning math concepts; teaching math concepts; understanding how children learn math; learning multi-media design; learning to use technology to teach a concept; learning to integrate design tools into teaching practice; providing a model for technology integration and math learning in classrooms; learning a particular software program; developing a resource intended for an audience of school and for an instructor to evaluate and provide a grade; and learning to work collaboratively with others and to extend this principle to classroom teaching. At the same time the project served an experimental and research purpose in relation to approaches to teaching in a teacher education program.

A number of pedagogical questions can be raised in relation to these multiple purposes. Did the task try to serve too many purposes? How can these multiple purposes be made clear to students? More specifically, did the math purpose complement the technology purpose and vice versa? And perhaps most importantly, did these multiple purposes assist students to extend the ways in which they were able to engage with and integrate ideas as part of their professional education and practice?

In thinking about these questions and in light of the analysis presented, two problem areas are immediately apparent. The first problem relates to the balance between mathematical goals, technology goals and social goals and how they can complement one another. For example during the process of assessing student assignments, Heather commented on the variation between the social effort, the technological effects and the mathematical quality. The problems for her involved balancing and recognising the students' varying levels of technical competence at the start, the collaborative effort associated with the production of the text and the actual mathematical and communicative quality of the final presentation. It also involved making distinctions between the 'look' of an assignment and its substance. In some cases, the quality of the final presentations was questionable and did not match the effort that students had put into it or was masked by 'hi-tech effects'. Heather talked about this as a problem of discrimination:

[The Hyperstudio project] didn't provide - if you want - discrimination - it was very hard to separate because of the multiple purposes and the affective aspect of it.

The issue that Heather raised about the varied purposes of the assignment is a critical one for understanding not only the process of assessment but also the value of the assignment. Certainly in some cases the varied purposes associated with the hyperstudio task served to extend the range of learning outcomes and broadened the range of connections that students were able to make between technology, math and teaching. In other cases this was clearly not so and it was the mathematical goals that typically suffered.

Having seen what was possible this year, Heather's concern for the future was to strengthen the math component, by way of linking the project requirements more specifically to course work and to the planning that students would do for a unit of work. In this respect she wanted to restructure the social and technological processes so that there was greater coherence with the goals of the mathematics education course. I think the key question here revolves around the mathematical purpose of the project and how it can include the production of a teaching resource and the experience of a model for learning that uses multi-media technology.

The second problem relates to the ways of balancing direct and instrumental links between campus and school with conceptual links. Hyperstudio and its use during the practicum is an example of a direct link. Considering ways in which multimedia can support learning and design and considering the teaching practices that could purposefully employ multimedia in classrooms is an example of a conceptual link. One of the student teachers made a detailed comment about the purpose of the assignment which is of value to consider:

I would suggest perhaps a little more front loading on the assignment with broader purposes so that students can see a broader range of what they are getting at. In other words, have more learning outcomes. Perhaps if broader purposes were included in the assignment description and explanation it would dampen some of the heartache that arose this time during the process [i.e. schools not having Hyperstudio software].

This student thought that the primary purpose of the assignment should be related less to the instrumental link between technology skills and their application in classrooms and more to 'conceptual' links between technology use and educational and pedagogical value. I agree with this student's comments but acknowledge that it is extremely difficult to develop conceptual clarity when the experimental and practical work needed to underpin this is still very much in its infancy. Furthermore, the conceptual purposes associated with technology use need to at least complement the procedural and pragmatic factors associated with technology use. Certainly in this case, had the software applications used on campus and school been better matched, the purposefulness of the task could have been better realised and students may have been in a better position to articulate their own theories related to using technology and a range of communication modes in classrooms.

Conclusion

In thinking about the extent to which the form of technology use in this case study served to extend student teachers' learning and engagement with the subject matter, three points stand out. First this multi-media design tool enabled students to work with and extend the ways in which they could represent mathematical concepts, especially combining graphic, symbolic and text-based representations of concepts. The focus on the visual

representation of concepts was seen as particularly important in terms of assisting students to understand processes of abstraction. Second, the computer provided a working space in which students could work in pairs and collaboratively design their presentation. This joint work proved to be of major importance in supporting a process of experimentation and extending students' understanding of the design capabilities of the software. Third, the links that this project afforded between campus and school, particularly in terms of technology integration, proved to be bitter/sweet. Students benefited enormously from Carole Saundry's input. She provided a model for how technology could be used in schools. In the cases where students were able to draw on their knowledge of Hyperstudio in the practicum there were significant benefits in terms of their thinking about learning and their status in the school. However in most cases students were unable to use Hyperstudio in their school setting and the chance to develop greater clarity regarding the procedures and concepts pertaining to technology integration were lost. Working on this problem is the next phase for the action research.

CHAPTER EIGHT

DISCUSSION AND CONCLUSION

Summary and Key Arguments

In this final chapter of the thesis I want to draw some threads between the purpose of this research study and the ideas raised in each of the chapters. The purpose of this research has been to determine whether and how information and communication technology (ICT) can be used to extend the levels of intellectual engagement and learning in a teacher education program. Responding to this purpose has required the following: developing a perspective on the nature of the intellectual work associated with learning to teach; reviewing current research investigating uses of technology in teacher education programs; formulating a conception of technology and its relationship to educational practices; and designing a set of projects in which the possibilities associated with ICT can be tested. I argued in the literature review that many claims are made about the value of ICT in teacher education, particularly pertaining to collaboration and community, with little by way of evidence that demonstrated the ways in which practices were collaborative, the conditions that enabled that collaboration to occur, or how that form of collaboration and community extended student teachers' professional learning and intellectual engagement. My concern was not with the general principles surrounding collaboration and community. These ideals are laudable, but they are not ends in and of themselves and need to be considered in relation to the range of teacher education goals that they might support. Moreover, they under specify the nature and type of conditions that can support and extend learning. Thus the project work undertaken in this study sought to specify the learning conditions and examine the evidence that might demonstrate whether and how the technology could be used to extend levels of engagement in ways relevant to teacher education. The key hypothesis was that certain technologies could provide the resources and the media to support and extend levels of inquiry and intellectual engagement. The more specific aspect of this hypothesis was that a set of communicative structures could be established that would enable students to

integrate and connect ideas, resources and experiences from the often disparate parts of a teacher education program.

In their study of technology innovation Bruce and Rubin (1993) argue that the ideals associated with an innovation are only ever partially realised. And so it was in this research. The ideals related to the technology were realised in different ways. As people built the use of technology into their teaching and learning practices they adapted the goals of the innovation for their particular purposes and interests. The learning outcomes of each project therefore reflect, and need to be considered alongside, the 'technology-in-use' (Bruce & Rubin, 1993), rather than the technology alone. That use reflected the enthusiasm, as well as the tension and skepticism associated with changing and adapting practices.

It is perhaps no surprise that the findings revealed through the analysis of each case show that the technology use was both productive and problematic. As Burbules and Callister (2000b) argue, any use of information technology has both promises and risks attached to it. It is never simply one or the other. That being said, the central research question still remains: In what ways, if any, could the technology be used to extend the intellectual engagement and learning of those in the program? The analysis of the processes and the content of the texts in each of three projects demonstrated that the use of technology in the CITE program extended the intellectual work and learning in two key ways: 1. The technology provided a medium for making connections between people, ideas, resources and experiences. This enabled students to integrate a range of ideas in ways relevant to their professional learning; and 2. The technology itself was an object of study. Students developed perspectives on educational technology that were critical, creative and practical. Underpinning these extensions were a new set of writing practices, changed pedagogical relations and opportunities for participants to research and reflect on the technology practices in educational settings.

While the research reported in this study showed some of the potential associated with using technology, the claims need to be counterbalanced with a consideration of the problems, pitfalls and flaws accompanying both the technology and the associated

pedagogy. These included a lack of clarity regarding the purpose of the technology and its relationship to face-to-face instruction and to teaching in schools; varying levels of appropriateness of the technology and electronic resources to the tasks at hand; varying amounts of time and degrees of interest for both the completion of the tasks and for working with the technology itself. Underpinning this layer of pedagogical problems was another set of implementation problems and issues, some of which have been documented in Chapter Four. These implementation issues provide another backdrop for the evaluation of the projects and I will briefly refer to these in this chapter.

In the section below I review the methods of analysis used in the study. This will be followed by a summary of the projects, the key learning conditions and their relationship to those parts of the projects that were productive as well as problematic. Following this will be a discussion of some of the issues emerging from the findings and their implications for teacher education.

Review of Evidence and Methods for Analysis

The evidence to support the arguments developed above has been based on an analysis of three sources of data - the texts produced by students as part of their assignment work, the reflections and evaluative comments provided by students and instructors through interviews, discussions, surveys and evaluations, and my own observations and records of the process of the project work. In analysing the texts, my particular concern was to document the ways in which students expressed their understanding of the relevant content and how this related to: the means of communication; the access to and use of web-based information and multimedia resources; and the types of pedagogical relationships between readers and writers made possible through the use of technology. The first part of the analysis of each project outlined the relationship between the context and the uses of technology. The second part of the analysis described the interactions and connections that were made between people, ideas, resources and experiences in each of the project tasks. The third part of the analysis considered the substance of these connections and the degree to which students were able to make connections between theory and practice, campus and practicum, experience and research, etc. This included the degree to which students brought to the texts their own experiences, research

resources or expectations for future practice, as well as the degree to which they took ideas raised in the text to other contexts, especially their practicum setting. The analysis then sought to consider the extent to which each assignment task assisted students to integrate ideas, justify points of view and develop theories of practice - these three related activities being crucial to learning to teach and the intellectual work in a teacher education program.

In the review of literature in Chapter Two, I suggested that too little attention has been paid in studies of teacher education and technology to the texts as artifacts of learning. The weight of the evidence in this study rests on a fine-grained analysis of the process of text production and the content of the text. My interpretation of the texts and of the learning in each project was augmented by, and corroborated with, the comments provided by project participants and my own observational notes. The students' comments provided insight into the processes they employed in undertaking the task and relating it to other contexts, as well as their assessment of the value of the activity. Students and instructors also read and commented on my interpretations of the texts and the activities. The purpose of this was to achieve a level of intersubjective agreement.

Summary of Projects and Findings

Each of the three projects - Ed Studies Online, Reading Online, and the Hyperstudio-Math Project - used technology in different ways and to suit the pedagogical purposes of the course. Table 7 below provides a brief review of key aspects of each project. Despite the differences between the projects there are some common features that are a key to understanding the learning conditions associated with the use of technology.

The use of web-based and multi-media technology in each project created a new set of conditions for writing and design that included: a wide and sometimes public audience; direct 'links' to resources and research; collaborative possibilities with peers and those in other professional communities; peer evaluation; and inclusion of first person perspective. This is consistent with the conditions for learning and intellectual engagement raised by Wells (1999), Bruce and Levin (1997) and Shulman (1999) in Chapter Two. This extended the range of teaching and learning relationships within and outside the CITE program. Furthermore, it enabled the purpose of, and audience for,

assignment work to be extended beyond a display of learning and a piece of writing to be read by only one instructor. These factors enabled students to generate and build on each other's ideas.

In the Education Studies Online task each discussion forum created a collective text by drawing on the ideas of peers and experts and by referring and linking to resource material. This activity in some cases enabled students to connect and integrate ideas generated through research, their personal and practicum experiences, and their campus-based coursework. This integration demonstrated the potential of this activity for not only extending students' understanding of issues pertaining to technology and equity in schools, but also to ways of addressing curricular fragmentation. Questions and problems in this project related to the reliability of web-based resources and the degree to which they were critically used; the lack of connection, in some cases, between the topic, the resources and the school context; and how the task could be more closely related to other parts of the Education Studies coursework.

The critical components of the Reading Online task were the access to web-based resources and the public forums. Connections were made between literacy research, personal and practicum experiences and other theoretical and practical ideas raised in the coursework. Students were also able to engage with a broad professional community of practitioners, academics and other students. Key problems and questions that arose during this project concerned the response rate and the degree to which some form of interaction could be sustained.

The Hyperstudio/Math Project, unlike the other two projects, was not so much concerned with using the technology as a medium for public communication but with designing a multi-media resource to explain a mathematical concept to an audience of school students. The project was designed to assist students to integrate mathematics and multi-media technology in ways that had direct relevance to teaching practice in schools. In completing the project students integrated a range of ideas from other curriculum areas and increased their own understanding of the mathematical concepts through the design process. Two key problems that emerged through this project related to the difficulty of

achieving a balance between the technological tools and the mathematical purpose of the activity and to the transferability of the multimedia skills to teaching practice in school settings.

The technology was not only a medium through which students communicated but also an object of study. Through a consideration of some of the complex issues associated with technology use in educational settings, and through reflecting on their own learning with technology as part of their involvement in this study, students were able to develop and extend their own understanding of technology in ways that were practical, creative and critical. In the Hyperstudio/Math project students reflected on the process of their learning and the application of such a program in a school setting. In the Education Studies project students examined ethical and educational issues pertaining the use of technology in schools. In the Reading Online project many students chose articles because they had a technology focus, and in so doing broadened their perspective on the relationship between technology and literacy education.

Table 7: Project Summary

	Purpose	Key Learning Conditions/Activities	Nature of Connections	Substance of Connections	Problems and questions
Education Studies Online	<ul style="list-style-type: none"> Collectively build ideas about technology, education and equity Critique research and practice 	<ul style="list-style-type: none"> Audience Peer evaluation Collective writing Finding and drawing on relevant electronic references Access to multiple perspectives and views of experts 	<ul style="list-style-type: none"> Peers External Participants OL resources Personal experiences 	<ul style="list-style-type: none"> Developing point of view based on relevant research, discussion and personal experience Connecting teacher education to matters of technology, education and equity 	<ul style="list-style-type: none"> Limited time and opportunities to build ideas Ways of linking to face to face and essay work Adequacy of resource material
Reading Online	<ul style="list-style-type: none"> Engage in professional and public forum Discuss relevance of research to practice of language education 	<ul style="list-style-type: none"> Public audience and evaluation Access to electronic resources Writing 	<ul style="list-style-type: none"> Peers and readers of ROL OL Resources Personal and practicum experiences 	<ul style="list-style-type: none"> Integrating and critiquing technology in schools Taking ideas from articles to school context and vice versa Connecting technology and literacy education 	<ul style="list-style-type: none"> Timing Response rate Negotiating varied purposes
Hyperstudio Math project	<ul style="list-style-type: none"> Explain and teach a math concept using Hyperstudio (multimedia resources) Begin to think about ways of integrating technology into own teaching practice Assess nature of own learning 	<ul style="list-style-type: none"> Audience Collaborative design Integrating of modes of communication 	<ul style="list-style-type: none"> Peers, Teacher from Richmond School District Representational resources and modes of communication 	<ul style="list-style-type: none"> Connecting activity to practical uses in schools Math, technology and other subjects 	<ul style="list-style-type: none"> Negotiating multiple purposes Balancing technology and math focus Software in schools Skill transferability

Discussion and Implications

In this final section of the chapter I discuss some of the claims made in the previous section in light of the teacher education literature and some of the more general literature related to technology and learning. My main purpose here is to highlight questions and issues that emerged from the study, consider the implications that the study has for teacher education and suggest some areas for future research. The three key areas to be discussed concern the conditions for learning, the degree of curricular and program integration and the study of technology itself within a teacher education program.

Conditions for Learning

In each project the technology was used to provide the forum, tools, and media to create a complex set of conditions for learning and for intellectual engagement. Key among these learning outcomes were a new set of writing practices, and along with this a new set of pedagogical relations. The conditions established in this project work had their own set of flaws and problems that need to be addressed. Nevertheless specifying the learning conditions that developed in these projects, and the associated problems, helps to flesh out some of the detail that I have suggested is lacking in the teacher education and technology literature. The conditions that developed in this study also provide some working examples that both derive from and inform the theoretical ideas on learning presented in Chapter Two. Writing as a form of learning and inquiry is made explicit in the three projects presented in this study because it provided a medium for both generating and reflecting on ideas through collaboration. The activities also provided students with the opportunity to draw on their past experiences and/or connect to future action. These activities are consistent with those advocated by Wells (1999) and discussed in Chapter Two. Moreover, the texts produced by students were to some degree public, they were informed by existing bodies of knowledge and they were reviewed by peers and others within the professional community. To a lesser degree those within the community used and built on the ideas developed by students. In this respect the activities surrounding the production of the text formed the basis for a set of conditions for research and scholarship (Shulman, 1999).

Those features that were central to the writing conditions across the projects included: a public audience for assignments; a professional as well as pedagogic purpose for writing; the potential to build in other media and to link to electronic resources; and the collaborative possibilities. Many of these writing conditions are, of course, possible without computer and web-based technologies. What makes the features of computer technology drawn on in this project distinctive is the relative efficiency and speed with which these features can be brought together into one 'writing space'. Two aspects of the writing process that I particularly want to discuss are the new sets of teaching and learning relations made possible through the writing practices and the potential and problems with electronic resources drawn on by students.

Teaching and Learning Relations

Bruce and Rubin (1993) noted that 'audience' and 'purpose' provided a key to understanding the use of electronic writing in the Electronic Quills research project. These two factors, along with the collaborative construction of ideas, were also a key to understanding the writing conditions in the three projects under discussion. Writing for an audience and/or writing in collaboration with others were important parts of the process of inquiry in each task. The purpose of the writing therefore included generating and testing ideas with others, engaging in the conversations that are part of professional practice, and demonstrating learning as part of course requirements. In this respect students' writing was not directed only to an audience of one, the instructor, which is typically the case in university assignment writing.

The audience across the three projects included at least two of the following: peers, instructors, invited guests, school students and the 'public' who read *Reading Online*. The audience played a different role in each task. Likewise the process of writing with others varied from task to task. However, in each case there was at one level or another, a form of 'joint construction' in which students either worked with others or built on each others' ideas. When viewed collectively, these writing conditions enabled students to:

- generate and reflect on ideas collaboratively;
- extend the ways in which they supported their ideas;
- invite public response to their ideas;

- take responsibility for what they were writing; and
- position themselves in a professional community.

The public and/or collaborative exchange of ideas created a new set of participant and pedagogical relationships. New evaluative roles were central to this. Peers, others in the professional community, and the instructors evaluated the ideas presented by students. Testing ideas in public and generating ideas with others was an important part of the principles of a community of inquiry. Assignment work therefore developed a focus beyond the display of knowledge; professional conversations relevant to the workplace became part of the writing of the assignments.

This shift in participant relations is not without its tensions. Students were negotiating the social and rhetorical demands of writing for multiple audiences and for different purposes. They were engaging in professional conversations and being assessed on their contribution to that conversation. This led to some uncertainty amongst some students, both with knowing how to frame their responses and concern about how they would be judged by others. With reference to university writing, Candlin and Plum (1999) note that this tension is related to the degree to which assignments direct themselves to a 'pedagogic goal' or to 'post-university professional or workplace goal'. They further this point by saying that students are simultaneously framed as 'professionals solving real world problems' and as 'students being assessed on their learning' (p. 211). They argue that these goals and the features of context surrounding the goals need to be carefully delineated in order to determine the degree to which they are 'corroborative of each other' (p. 212). In these projects I would suggest that the purposes were corroborative because they were focussed on making connections and integrating program parts. At the same time, it is perhaps inevitable that there will be multiple goals underpinning writing tasks that are part of professional programs of study. In this respect a question for our own teaching concerns not just the degree to which these goals are explicit, but also the clarity surrounding the social and rhetorical skills needed to negotiate tasks with varied goals and purposes. An important part of this is the need to clarify the relationship between the technology and communication goals and the content goals. A second question relates to the dilemmas associated with assessing such tasks, particularly

developing criteria sensitive to pedagogic and social goals, academic and professional goals, and technological goals.

Access to resources

A distinctive feature of the *Reading Online* and Education Studies Online tasks was the access that students had to electronic resources relevant to course goals or the assignment task. More important was the way in which they could build on those resources in their writing. In the case of the Reading Online task, students responded directly to published articles in the journal, thus becoming part of a research process. This means of responding to published articles is not possible in print journals. In the Education Studies discussion students created direct links in their texts to web-based material. While this has tremendous potential in terms of building a linked text, some caution is required when considering the quality of web-based material and exactly how these links were used by students. It is worth recalling that of the links made in the Education Studies discussion, some 37% were simply that - a link with no argumentation attached. Burbules and Callister (2000b) suggest that this may be a new form of argumentation: 'Arguments here may rely more on linking and recombining elements, making juxtapositions that suggest or invite a connection, but do not "argue" for one' (p. 54). Equally, it could be suggested that this is not a form of argumentation at all, because it requires little or no analysis of the material. Furthermore, arguments constructed around, or citations from, material that is of dubious quality can be equally problematic. While in this case I have argued that the citations strengthened the quality of the discussion by providing a wide range of source material, there is clearly room for more discussion on what it means to critically use such source material and how that critical reading can be built into the teaching and learning practices.

In the Hyperstudio Math assignment the resource was the software and its multimedia capabilities. This made possible various extensions to the ways in which math concepts could be represented - it opened up the possibility for the presentation of an assignment in a form that went beyond writing. A process of design was crucial for linking text to graphics, sound and animation. This was particularly well suited to extending the array of ways in which mathematical concepts could be represented, highlighting in particular

visual modes of representation. However in this project the problem was one of balancing the mathematical and pedagogical purpose with the technological effects. Certainly in some cases the 'special effects' associated with using the software overshadowed the mathematical and pedagogical purpose of the task.

Connecting and Integrating Ideas

In this part of the discussion I want to consider the real and potential benefits associated with the technology in the specific context of teacher education. I have suggested that the technology use did provide some avenues for curriculum integration. What were these and what consequences might there be for those efforts at program reform seeking to develop a coherent set of practices? The technology was used to create the conditions in which students could make a variety of connections with their peers and other interested parties and between various resources, experiences and ideas. In some cases, although certainly not all, this did enable students to connect and integrate theory and practice, research and personal experience, and campus and practicum experience. Some of the interactions within Education Studies Online and Reading Online served to illustrate, in a very tentative way, the type of integration proposed by McIntyre (1990; 1992) in which ideas raised in the campus-based parts and school based parts of programs are evaluated using both practical and theoretical criteria. In the gender and technology discussion for example, students asked how they could 'see' a concept like power in the classroom and what they could do about it in their teaching practice. They were also able to examine conditions in schools in light of theoretical ideas related to gender relations, equity and power.

A distinctive feature of both the online projects was the degree to which student teachers brought their personal experience to bear on their writing. This included either their past experience as a student in schools or their more recent practicum experience. There were also occasions in which students saw connections to future practice or indeed drew on the ideas gained through the project to inform their teaching during the practicum experience. Making connections and integrating personal experiences with the topic at hand is seen as important in both the literature on learning (Wells, 1999) and the more specific literature

on learning to teach (Wideen et al., 1998). Students were able to examine their own experiences and beliefs in light of a wider set of experiences, practices and theories.

The connections and integration of ideas that took place in the Hyperstudio/Math assignment were of a slightly different kind. One level of integration was a very pragmatic one, which focussed on thinking about ways in which computer technology could be integrated into classroom teaching practice. The key problem in this project was the degree to which students were able to transfer the technical and pedagogical skills learnt at the university setting to their school setting. On the one hand there was little by way of alignment between the software used on campus with that used at schools; on the other hand students did not necessarily see their skills as generic and transferable to other software.

Contribution to a Reform Agenda

I have suggested that the use of technology in this study, while limited, provided a means of encouraging some degree of program integration, cross-course connection and engagement with the wider professional community. Given this, it is of value to speculate on the degree to which such uses of technology represent a 'wedge' of reform in teacher education.³⁰ How far do the efforts and outcomes associated with these projects address some of the problems associated with curricular and structural fragmentation discussed by Tom (1997) and Gore (1995) and referred to in Chapter Two? I will respond to this with reference to both my own study as well as the technology and teacher education literature.

First, talk of 'technology' seems to bring with it its own set of problems. Partially addressing one communication problem opens another equally vexing problem related to 'technology implementation', or 'technology integration'. Developing a level of technology use across a whole program has been difficult, if not impossible in this teacher education program, which is a relatively small one. There was neither systematic integration of technology within courses nor systematic use of technology as a tool for

³⁰ The term 'wedge' is used by Grimmer (1995) to describe small scale efforts that can provide the starting point for reform.

curriculum integration and cross-course communication.³¹ In the literature there are few reports that document the use of technology over a sustained period of time, or that use technology as a tool for program wide communication.³² I suspect that this speaks to the fact that implementing and sustaining such initiatives, particularly at a program-wide level are extremely difficult. In Chapter Four, and in the discussion of each of the projects, I have documented some of the impediments to the implementation of technology in this study. These impediments and the effort and resources required to overcome them have certainly made me question the relative value of the positive outcomes that accrued from the projects. There remains an impasse between the recognition that something needs to be done in teacher education regarding ICT, on the one hand, and on the other the uncertainty about what to do and how to do it and the justifiable skepticism surrounding the educational value that might accompany technology initiatives. The challenge I suspect, is for those working in the technology and teacher education area to demonstrate both the nature of the implementation problems and how they are managed and how technology can be used purposefully across a number of courses. This research has been a modest attempt at this.

Second, I have suggested that the use of technology in this program was both a partial and limited response to the problems of fragmentation in teacher education programs. For it to be more than this it would need to be coupled with other reform efforts addressing the same problem. In this project the connections between ideas, resources, people and experiences made possible through communicative means both reflected and enhanced the goals and structures of the CITE program - a cohort model and an explicit set of program goals pertaining to curriculum integration. Certainly in this program the structures for communication, both technological and organisational, extended the relationship between program parts and those working in them and the opportunities for collaborative endeavours involving groups of students, instructors and teachers.

³¹ I hope I have demonstrated, however, that this use of technology did become more systematic over the three year period.

³² The Teleapprenticeship program at the University of Illinois (US) and the Telelearning Projects concerned with educating the educators are two notable exceptions. In each project there has been ongoing research over a period of years. However, to my knowledge, the use of technology in these projects does not directly concern itself with technology as a tool for integration at a program wide level.

However, in this research project, and in most others in the literature, the electronic communication structures were laid over the top of a fairly traditional set of subject structures. The purpose of the associated activities was to try to integrate, to make some connections between ideas. The overriding concern was to see how things could better fit together, not to examine the reasons why they may be separated in the first place. In saying this I do not want to undercut the main thrust of my argument - seeing these connections is difficult and challenging work and has been important in this project. However, substantive reform may require, as Luke, Luke and Mayer (2000a) advocate, a reconsideration of the 'traditional knowledge bases of teacher education' (p. 4), a questioning of the intellectual, pedagogical and institutional structures surrounding the organisation of foundations, curriculum studies and practical studies.

The point that I take from this is that if the integration of technology is going to be part of any substantive reform in teacher education then its use needs to be coupled with other efforts at reform that critique and redesign those practices identified as problematic. A report discussing the dilemmas surrounding the implementation of technology in schools is relevant here. In this report the authors argue that:

Information Technology is neither the problem nor the solution. It can, however, play a key role in a futures-oriented reform of pedagogy. It can do so both as an instructional mode and as a medium for building and sustaining professional development learning communities. (Luke et al., 2000b, p. 21)

This has direct relevance in this particular teacher education context. This topic is further addressed in the next section.

Technology as an Object of Study

Most of the technology and teacher education studies reviewed in Chapter Two presume, or make the argument that, technology should be integrated into teaching and learning practices. In other words it should not be a 'stand-alone' subject. The arguments presented in this study support this view. The technology was a useful tool in each project, and it was used in ways that extended the understanding of varied subject matter and educational practices. However in this study the technology was more than a medium for learning. It was also an object of study. In Education Studies the equity issues

associated with technology in schools were considered. In the *Reading Online* task students read about and discussed the relationship between technology, literacy and language learning. Students worked with Hyperstudio by way of considering its application in school contexts. Moreover, in association with the research process, students and instructors had the chance to evaluate the technology and the pedagogical practices associated with its use. In this respect the technology was not merely a tool but also a set of practices worthy of study, critique and redesign. This point ties in with theories of technology discussed in Chapter Two. It also speaks to the pervasive effect of computer technology in workplace practices in schools and universities in countries such as Canada, as well as the need to take some responsibility for what those effects might be.

Through both their use and study of educational technology students in the CITE program saw themselves as knowledgeable users of technology and as designers of technology use in schools. Over the year students talked about their growing confidence in using technology and spoke with greater authority about the ways in which they would use it. For example, five of the eight students in the focus groups developed a technology project during their practicum experience. Each project was initiated by these students, it was integrated into coursework in ways that sought to extend levels of communication and inquiry, and it represented a change in the way that 'technology' was normally taught in each of these classrooms.³³ Students in this respect were taking the notion of design, as well as technology, to their curriculum planning and practice in the way advocated by Kress (1998). The critique that some students in the Ed Studies Online discussion made of the technology practices that they saw in schools is another example. In this case they critiqued the use of 'expensive typewriters'. In engaging in this critique they were questioning the resources allocated to the technology, as well as the limited ways in which the capabilities of the technology were being explored in many schools.

While I have suggested that the technology had a cumulative effect and was more than just a tool, there was no explicit curriculum structure that assisted students to draw the technology threads together in ways that might inform their understanding of the

³³ Detail of two of these have been described in chapters concerned with the Reading Online project and the Hyperstudio/Math project.

technology research and its educational implications. The following comment by a student helps to explain this:

I don't want to say the reflection word.... But in a job interview I was asked if I could set up a network, and really all our technology uses were based on a network. I didn't say that because I didn't know and maybe reflection might help us to know what we really did.

There are two things pertaining to this student's comment. First the interviewer may have been asking a technical question. Did the applicant know how to set up a network of computers in a school? In this case the student did not have the technical skills needed to do this. Furthermore, learning these technical skills was not part of the technology agenda in the CITE program.³⁴ Second, if the student's interpretation of network is taken as metaphoric, her point is an important one, because certainly much of the technology use in the CITE program was oriented toward creating networks between people that would support and extend learning. I think she is correct in suggesting that there was not an opportunity to make this knowledge about technology explicit. Certainly through the process of the research students did have an opportunity to review their own learning and evaluate the effects of each project, but there was little time for any whole-class discussion on this matter, or opportunity to consider the collective effects and purposes of the technology. Equally, in my role as researcher, I could, and in retrospect should, have provided more information regarding the projects and their purpose.

Perhaps the irony here is that the parts of the technology work were fragmented. I am not suggesting that this creates an argument for a technology subject which is simply slotted into the existing and overcrowded curriculum. Nor do I think that this undercuts the argument for the integration of technology into coursework. However, I am suggesting that if an expansive view of technology is acknowledged, and ways of connecting the multifarious uses and conceptions of technology are to be encouraged, then there is a

³⁴ The fact that little attention was paid to technical matters such as lab troubleshooting, loading software, working on different platforms, etc, was a concern raised by many students. It is a valid concern but was beyond the scope of this particular research project. It is certainly an issue that needs to be addressed when developing curricular practices that have a technology component.

need to rethink the curriculum structure in ways that might better enable students to understand these conceptions and make the connections.

The model for practitioner research that has been developed in this study provides a tentative beginning for rethinking the curriculum structure. This research model was well suited to the context - one in which there were few local precedents, and in which there is much uncertainty, where expertise is not necessarily in the hands of the teacher and where there is rapid change. What the model allowed for was a degree of participation, risk taking and experimentation. While my intent was to make this research participatory, there were obvious limits to instructors' and students' participation. These limits typically related to time and interest. Thus while technology became embedded in the curriculum, the process of research did not.³⁵ My question is whether such a model for research could become part of the curriculum. In a program such the CITE cohort model there is some opportunity for this because time is set aside within the timetable for student inquiry. The practices pertaining to technology could be one object of the inquiry. However this cannot be an activity undertaken only by students, but must also include instructors. Nor should it be an activity that is simply added to the existing curriculum. When conceived in the above way, the combination of information and communications technology and a model for action research could constitute a wedge for reform of the content and pedagogy in the teacher education programs.

Such a model requires both advocacy and critique of educational technology. Taking on these positions simultaneously has been discussed by Burbules and Callister (2000b), Kress (1998), as well as de Castell, Bryson and Jensen (2001). Central to their work has been the critique and recreation of new practices from inside a practice. As such, each of these theorists has developed an explicit educational, ethical and political stand on matters pertaining to educational technology. It is not just a matter of knowing how to integrate technology into teaching practice, but also being able to take an informed stand on educational uses of technology.

³⁵ I want to qualify this to some degree - there was certainly a level of participation in the research amongst students and instructors. Indeed I think that once students realised that the technology projects were experimental they were much more willing to accept imperfections and flaws, to take risks, to participate

Future Research

There are a number of avenues for research that could be fruitfully pursued and that would both augment and extend understandings of how pedagogical and communicative practices in teacher education are changing in light of new technology, and the degree of control that practitioners have in shaping those changes and assessing their value. Certainly in the three projects discussed in this dissertation there is room for further research. This could include addressing the problems already discussed and refining the process of research.

Furthermore, there is still considerable work to be done exploring the use of communications technology for program-wide and cross-course communication. One particular avenue in which there is much possibility is in the area of the practicum. Communication between campus and schools is notoriously problematic in teacher education programs. It would be of value in this context to explore how the technology could be used for organisational and pedagogical purposes. There is also the potential to explore ways in which the technology can be used to create a greater degree of articulation between campus-based courses. For example an online discussion could be a component of two or more courses. The Hyperstudio-Math assignment could be easily linked to art, music or language education. Building flexibility into coursework through communications technology is one more site for future experimental research. For example, creating virtual class space as a limited or occasional alternative to face-to-face meetings may be one way of addressing problems associated with a heavy weekly schedule of classes and large class sizes.

Each project also highlighted the need for further research that examines the alignment between university and school practices that are associated with assisting students to use technology in their own teaching practice. In part this raises questions about the compatibility of hardware and software across sites. In part it raises a larger set of questions regarding the ways in which technology is conceived as part of curricular

and to critique the practices. Yet the research involvement was related to more to this study than to the teacher education curriculum.

practices in schools and teacher education coursework. There have been indications through this study that the conceptions held by teachers, student teachers and teacher educators are not always complementary. A close examination of the ways in which technology is conceived by the various players in a teacher education program may provide an important starting point for designing practices that are based on complementary conceptions. In particular there is a need to explicate the points of overlap and the key differences between the varied ways in which technology might be used in teacher education programs.

This study also demonstrated that many students are willing to take risks in their practicum and are not dependent on their school advisor's knowledge when building technology into their curricular planning. In these cases students had expertise that was highly valued in the school setting. Documenting the effects of this and planning activities in which this expertise can be shared amongst practicing teachers would be a fruitful avenue for research. To add to this it would be of value to consider the technology practices that students adopt in their initial years of teaching, particularly to consider the degree to which the technology is used as part of professional communication and learning and the ways in which it is integrated into teaching practice. Using the technology for on-going professional communication may be one way fostering links between pre-service teacher education programs and the first couple of years of teaching.

There is now recognition that teacher education is central to any form of technology use in the school curriculum. However little attention has been paid to the education of teacher educators with regard to how they might learn to build technology into their teaching practice in ways that might assist student teachers understanding of educational technology in schools. An obvious gap in this study has been a close examination of the ways in which teacher educators have responded to the use of technology in their teaching practice and the conditions that enabled and constrained their learning in this area. To my knowledge there is little in the literature that addresses this question.

Comparative studies provide one other area for future research. An obvious limitation of this study is that it is based on only one case. Considering technology use in other teacher education programs, as well as other professional courses would provide a useful starting point for elucidating those features of technology use and teaching practices that are specific to the setting and those that may bear some relation to other contexts.

Conclusion

While this thesis is concerned with new computer technology, it is perhaps more importantly concerned with the communicative practices that are part of teaching and learning in a teacher education program. The technology is one medium through which teaching and learning can be enacted. Amidst the rhetoric surrounding educational technology and given the various struggles within many educational institutions to build technology into teaching and learning practices, there remain many questions about the degree to which the technology can be used to extend teaching and learning practices in productive and worthwhile ways. This research, therefore, has sought to consider how conceptions of technology can be linked to pedagogy in ways relevant to professional learning and engagement in a teacher education program. While the outcomes of the research do not necessarily demonstrate the 'much talked about utopian visions' (Kress, 1998, p. 79) associated with communications technology, what they do demonstrate is that the technology can be used as a medium for public inquiry, that the technology itself is a worthy object of study and that there is need for those 'inside' educational practice to continue to critique, design and refine both the technology and the teaching and learning practices associated with its use.

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Appendix A - Consent Form

Consent Form

University of British Columbia

Research project conducted by Jane Mitchell

Communications technology and learning to teach

This letter constitutes your written consent to participate in a research project aimed at assessing the value of communications technology as a tool to extend the learning of those involved in a teacher education program. Please read this form carefully before signing and feel free to ask any questions regarding the project and your involvement in it.

A focus for this research is an analysis of the teaching and learning practices that are part of the coursework of one teacher education program that is building communications technology into its practices. The purpose of the analysis is to understand the contextual issues related to the use of technology and the extent to which the technology supports the goals of a community of inquiry. More specifically the analysis will focus on the means by which participants in the program use the technology to investigate, organise, represent and publish their ideas particularly as a means of integrating academic and professional knowledge. The research component of this work will include the use of focus group discussions, individual interviews, surveys and a consideration of the some of the communication mediated by technology.

For those who agree to participate in focus groups and interviews, these discussion will be recorded on audio-tape as a means of providing an accurate record of comments. Transcripts of tapes will be provided to those involved in the interviews or focus groups for comment and amendment through the course of the research. At the end of the project the tapes will be erased.

Your participation in any of these activities is strictly voluntary and you may withdraw at any time from these research activities, without prejudice, even if you sign this letter of consent.

Here is a summary of the main issues related to the research activities:

- All data collected will be confidential and anonymity will be maintained. Tapes will be erased at the completion of the project.
- You may refuse to participate or may withdraw at any time from these research activities without prejudice, even after signing the consent form.
- At any stage of your involvement in these activities you may request clarification on any issue regarding the project.
- This project will not involve any risk of any kind whatsoever to the participants in the project.

Should you have any concerns or questions about your rights or your treatment in this research project you may contact Dr Richard Spradley, Director of the UBC Office of Research Services and Administration (822 8598) or Dr Gaalen Erickson (822 2733).

I, _____, have read the above and have had the opportunity to discuss in full the nature of this project. I understand that the research component will be done as unobtrusively as possible, with minimum disruption to normal class proceedings and in consultation with me. I give my consent to participate in this project and acknowledge receipt of a copy of this document.

Signed: _____ Date: _____