COMPUTER SELF-EFFICACY AND CLASSROOM PRACTICE: WHAT IS THE CORRELATION?

LORRAINE CATHERINE BEAUDIN

B. Ed., University of Lethbridge, 1989

A Thesis
Submitted to the Faculty of Education
of The University of Lethbridge
in Partial Fulfilment of the
Requirements for the Degree

MASTER OF EDUCATION

LETHBRIDGE, ALBERTA

March, 1998

DEDICATION

To Lance, Conor and Alison.

ABSTRACT

The present technological focus in education is requiring teachers to become computer-literate so that they are better able to integrate computer technology into their teaching. This thesis examines teachers' levels of computer self-efficacy (one's belief in one's ability to use computers) to see if there is a correlation with computer self-efficacy and classroom practice.

Current research suggests that one can use computer self-efficacy as a way of determining teachers' levels of willingness to use computers. Based on the distribution of a computer self-efficacy scale and a questionnaire designed to identify computer technology integration into teaching, this study shows the correlation between computer self-efficacy and classroom practice in a selection of schools in southern Alberta.

The findings of the research show that there is a weak correlation ($r = 0.405$) between CSE and classroom practice; while there is a moderate to strong correlation ($r = 0.62$) between CSE and instructional practice. Interestingly, the correlations between CSE and each of the specific classroom uses listed in the survey were extremely weak. These correlation coefficients ranged from 0.077-0.287.

Only 14/87 of the teachers surveyed have not attended a computer course. However, out of those 14 teachers only 2 do not use the computer for classroom use. On the other hand, of the 73 teachers who have attended a computer course, 16 do not use the computer in classroom teaching. For this group of teachers, participating in a computer course did not appear to have an impact on classroom practice. Moreover, the research found that those teachers with high levels of CSE do not necessarily teach using computers.

An exploration of change literature provides a framework for understanding these

results, and helps place in perspective the need to rethink guidelines for professional development, teacher education and classroom practice as they relate to computers in education.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I
INTRODUCTION

Teachers are currently being asked to become computer literate and to integrate emerging computer technology into their teaching. Because computers are a relatively new phenomenon in education, it is important for educators to understand what level of impact teachers' degrees of computer self-efficacy have on their teaching. This study addresses the question, How do teachers' levels of computer self-efficacy affect the implementation of computers into their classroom teaching? This information is important because if levels of computer self-efficacy do have a significant impact on the implementation of computers into classroom teaching, then instruments that can measure computer self-efficacy could aid schools in the development of technology implementation plans that specifically address the needs and abilities of their teachers. If, however, contrary to conventional wisdom, there are influences other than teacher expertise in computer knowledge that are responsible for the implementation of computers in the classroom, those 'other influences' need to be identified.

Genesis of the Problem

When I first began to teach business education in 1989, I realized that I chose a career that is constantly changing. As a computer teacher, my current job title has gone through several revisions: in 1989 I was a business education teacher; in 1991 I was an office administration instructor; in 1993 I became a CTS (Career and Technology) teacher; and, today, I have the title of Information Specialist instructor. Four titles describing the same type of job!

The constantly changing job title is the result of a constantly changing field of study. On average, I spend more than 25 percent of my work week learning new software and developing new instructional resources. Because the business community is continually trying to improve productivity by using the most up-to-date computer programs, I teach students how to use the latest business software (databases, spreadsheets, word processing and accounting software) so that they are best able to perform efficiently within a business environment.

Personally, I view technology as a tool--a tool in the sense that it makes some of the jobs I perform easier. I keep track of my students' grades and develop professional-looking documents in very little time. I complete research in the comfort of my own home, while my children are upstairs, fast asleep. I correspond with my distant relatives, friends and colleagues in a timeless environment, at my convenience. All of these tasks have been made possible through the use of technology. In part, because of this, my view of technology is different from those educators who believe that technology will improve higher order thinking skills in students. It is not that I doubt the use of technology can accommodate the development of higher order thinking skills. Rather, I view technology as an instructional tool that, if properly adopted, can become so accommodating. I feel that technology is of little value in the classroom by itself. Proper pedagogic intervention is necessary in order to utilize the computer technology and transform it into an effective classroom strategy.

Because I teach about technology, the computer skills I need to do my job are different from those of an English teacher or a grade four teacher who use computer technology in his/her classroom. I am primarily concerned with the 'how to' skills of a particular software package and I teach these 'how to' skills utilizing "business" as a framework. For example, I may show my students how to use WordPerfect templates so that they can prepare professional–looking memorandums, reports or letters.

Significantly, the type of software largely dictates how it is to be used for effective integration. For example, most educational software packages are very user-friendly and do not require a lot of computer skills to use. This is illustrated any time someone watches a young child maneuvering around a software program. If the software is understandable and accessible to young children, then it should follow that teachers would have those skills needed to run the program as well. My argument is that the development of educational software is not focussed on a specific set of computer skills. Certainly, there may be the need to know how to use a mouse or other input devices but, typically, educational programs are readily available to students and teachers because the computer skills needed to run them are few in number. Depending on the grade level of the software, high level reading skills may not even be required. The ability to follow straightforward instructions and use an input device are often the only reading and psycho-motor skills needed to run much of the existing educational software. If this is the case, then training teachers to become computer literate may be unnecessary.

When computer technology first became inter-disciplinary, its integration was actively encouraged. Surprisingly, many felt that teachers needed to become knowledgable about the 'basics' of word processing, databases, spreadsheets and multi-media. Personally, I was not convinced that these particular computer skills would enable teachers to teach with technology in their classrooms. Intuitively, I began to wonder what research question I could ask that would help me identify whether or not this was the case.

As a result, I began to research the topic of computer self-efficacy (CSE), and realized that if I could show that there were teachers with high and low levels of CSE who integrated technology into their classroom teaching and that there were teachers with high and low levels of CSE who did not integrate technology into their classroom teaching, then I could demonstrate that there was not a *significant* correlation between the two variables. Because CSE can be used to predict computer behaviour (ie. those with high levels of CSE are likely to use computers more often) I could show that the computer skills and/or high computer usage do not alone necessarily translate into classroom practice. This outcome, I felt, would be important enough to cause those involved in teacher education programs and those involved in professional development to investigate other key areas that may facilitate the integration of technology into classroom practice; or to question whether it is always appropriate to integrate technology into the classroom.

Focus of the Study

Currently, there is a general belief that computer self-efficacy can be used as an indicator of the likelihood of teachers' integration of technology into their teaching. If there does not exist a strong correlation between high levels of computer self-efficacy (which can be achieved through computer courses and usage) and the implementation of computers into the classroom, then schools should be identifying other variables that may be responsible for teachers not implementing computers into their classroom teaching.

My hypothesis is that a moderate level of computer self-efficacy may be necessary but not sufficient for getting teachers to integrate the use of computers into their classroom teaching. Self-efficacy is one's belief in one's ability to perform a desired outcome. Computer self-efficacy is the belief in one's ability to perform a desired outcome using a computer. There is much support for the thesis that computer self-efficacy is a valuable indicator of whether or not teachers will implement computers into their teaching, (See for example, Oliver et al., 1993; Delcourt and Kinzie, 1993; Overbaugh & Reed, 1992). What is unclear, however, is exactly what these authors mean by *the integration of technology into teaching*. Integration of technology can be divided into at least two categories: technology used for instructional purposes (e.g. word processing exams or using spreadsheets for recording student marks) and technology used in classroom teaching (such as UltraKey for learning keyboarding, or using browser software to conduct research on the Internet, or using statistics software to work out statistical problems). In public education, the aim of the integration of computers in education seems to be more associated with the latter, yet most authors have failed to make this distinction between teachers using computers for instructional purposes, and teachers using them for their classroom teaching.

A study by Grangenett, Ziebarth, Koneck, Farnham, McQuillan and Larson (1992) as cited by McKenna (1995, p. 4) explored the statistical relationships of computer anxiety, computer literacy, equipment familiarity, age, learning style, gender and teacher area, to a trainee teacher's anticipated use of multimedia. The results showed that familiarity with equipment (computer-literacy) was not found to have a significant statistical relationship with any of the variables. The results tend to suggest that familiarising trainee teachers with multimedia components does not really encourage the use of multimedia in the classroom. The authors concluded that the results implied that less emphasis should be placed on multimedia equipment in training sessions and more on the instruction of multi-media applications in the classroom (McKenna, p. 5). In other words, teach teachers how to teach *with it*, rather than only teaching how to use *it*.

The primary focus of this study will be the relationship of computer self-efficacy (hereafter to be referred to as CSE) to classroom practice. This study should also be able to identify if high levels of CSE are more closely linked to the use of computers for instructional purposes than the use of computers in classroom teaching.

The integration of computer technology into teaching falls within the confines of school reform. It would be contrary to contemporary change literature to suggest that the integration of technology into schools, as a reform movement, could be achieved by simply giving teachers the skills they need to become computer literate. As Michael Fullan and Matthew Miles state:

> Education is a complex system, and its reform is even more complex. Even if one considers only seemingly simple, first-order changes, the number of

> components and their interrelationships are staggering: curriculum and instruction, school organizations, student services, community involvement, teacher in-service training, assessment, reporting and evaluation. Deeper, second-order changes in school cultures, teacher/student relationships, and values and expectations of the system are all the more daunting (1992, p. 746).

In agreement with Fullan, I believe that the success of the integration of technology into the classroom will be a result of more than the presence of computer-literate teachers in highly technological environments.

Because our present educational system is embracing technology with a certain intensity, it is vitally important that educators take greater responsibility for understanding new technology from both a theoretical and practical viewpoint. Teachers should be expected to develop a position on technology, and develop those skills necessary to use that technology. They must also be able to make sense of and function effectively in an environment which focuses on the technical delivery of information. As a preliminary step, when teachers are asked to integrate computer technology into their teaching, they should at least be given the opportunity to challenge the underlying assumptions of such an initiative. Allowing teachers to do so would be consistent with the work of Fullan (1993) and others who agree that the teacher must be an active participant in the change process. In developing curriculum plans that integrate technology, teachers should be encouraged to make explicit their beliefs and assumptions about the use of technology.

As Bartow, Kirkwood and Foster argue:

> A curriculum is a plan for classroom instruction that integrates philosophy with action. Classroom instruction is relevant only when there is a clear understanding and definition of its purpose. As an emerging educational

field, technology education has a philosophy that guides its curriculum development. It is important for technology educators not only to understand the philosophy of technology education, but also to apply it to their educational efforts. (1996, p. 1)

Theories regarding the appropriate use of technology and strategies for their integration in schools must be attended to and reflected upon. Questions such as, Why have the technology? What are the implications for incorporating this type of technology? and What role should technology take in education? need to be asked and answered, for they seek to identify the value or the practical utility of the technology in question.

Such questions are qualitatively different from questions often posed by practicing teachers, questions such as: What methods do I use to integrate technology into my classroom teaching? and How can a spreadsheet package improve my instructional practices? Bartow et al. (1996) would suggest that both types of questions are necessary in the implementation of any technology curriculum. Perhaps this should be the case, but is it the case today in Alberta, where it is now mandatory for teachers to become "computer literate"? Can teachers both try to familiarize themselves with new educational technologies *and* open their minds to philosophical questions regarding the appropriate role of technology in education? Can they attend simultaneously to both the practical and theoretical considerations around this issue?

While teachers can use technology in their personal lives, for instructional purposes, or for their classroom teaching, the use of technology itself can demonstrate an attitude towards technology which can be a very good indicator of classroom practice. At a basic level, if teachers think computers are excellent instructional tools, they may be sufficiently encouraged to use them in their classroom teaching. If, on the other hand, teachers fundamentally disagree with the technological movement, they may be less inclined to make efforts to implement technology into their teaching even when they use the technology for their personal use.

More effective educators generally tend to question their actions, implement activities, question those activities, revise and re-implement them. They are not only concerned with the practical situation at hand but also the theoretical assumptions which ground that practice. As Galligan (1995) states,

> The role of the teacher is critical to the effective use of computers for learning. The choices teachers make about by whom, when, where, how and why computers are used in their classrooms can have more impact on learning outcomes than the content and structure of a particular software program. (p. 1)

Fundamentally, this suggests that teachers need to see value in the innovation they are being asked to implement. If they do not see value in the innovation, they will probably not implement the innovation into their classroom teaching even if they are skilled in using it.

At the core of many school-based technology plans is a goal for all teachers to become computer-literate. The basic assumption underpinning such a movement is that computer literacy will give teachers the skills they need to integrate the technology into their teaching. Such a primary focus discourages teachers from both asking questions about the use of existing technology, and from developing a philosophy of technology for themselves. Rather than encouraging dialogue about the appropriateness of technology in education or dialogue about the implications of a technically focused curriculum, teachers are asked first to become computer-literate. This top-down form of educational reform often does not succeed.

According to Fullan (1993), such an approach does not succeed because it fails to consider the role of the teacher as a *change agent.* He states that teachers act in various ways which, by design, seek to better existing situations and circumstances. To a degree, teachers, therefore, are moral practitioners. They have a moral purpose; they want to make a difference, and they have concerns for bringing about improvements (Fullan, 1993) Teachers, therefore, need to be *involved* in change.

But Fullan (1993) suggests there is more. While it is necessary that teachers have moral ends or goals, it is not a sufficient condition for the possibility of them becoming effective change agents. They need the means or material conditions as well:

> In addition to the need to make moral purpose more explicit educators need the tools to engage in change productively. Moral purpose keeps teachers close to the needs of children and youth: change agentry causes them to develop better strategies for accomplishing their moral goals. (p. 12)

Fullan lists four core capacities for building greater change capacity: personal vision-building, inquiry, mastery and collaboration. In exploring Fullan's idea of the teacher as change agent, one can see that the integration of technology into classroom teaching may not be possible until teachers are given the opportunity to cultivate the desire to do so. In other words, only those teachers who are able to: (1) identify *personal vision-building* in the exploration of technology in education; (2) develop an attitude of *inquiry* about the technology; (3) develop *mastery* related to the acquisition of computer skills and integration of technology in teaching skills; and (4) work towards an environment of *collaboration* with other educators, will effectively act as change agents in the integration of technology into their classroom teaching. It would be understandable, then, to find that the correlation between CSE and classroom practice is not so strong as the policies that are grounded in that belief, might assume. Computer integration is a complex issue. Unfortunately, we often seek a tangible goal to attain. Getting teachers to be computer literate and providing schools with computer technology are tangible goals but they may not be all that is required to create the reality of the integration of computer technology into classroom teaching.

CHAPTER II

LITERATURE REVIEW

This chapter begins by defining self-efficacy and leads the reader through the process of adopting a self-efficacy scale. Next, I identify the connection between change literature and technology implementation; illustrating the importance of understanding computer integration as a major reform movement in education. Lastly, factors that may influence teachers to adopt computers into their classroom practice are outlined and discussed.

Defining Self-Efficacy

Computer self-efficacy can be defined as "individuals' beliefs of their capability of using the computer" (Oliver, et al., 1993). Social cognitive theory provides a theoretical model which includes the construct of self-efficacy. This construct has been proven to be an effective tool for measuring behavioral outcomes. Presently, several studies exist that measure computer self-efficacy and use the construct as an independent variable to assess its causal impact on dependent variables ranging from faculty adoption of computer technology to gender differences in computer usage (Maitland, 1996).

Research strongly shows that self-efficacy can influence behaviour (see for example Bandura, 1992; Delcourt & Kinzie, 1993 and Maitland, 1996). Miura (1987) shows that a person's self-efficacy towards a task will influence the decision to take on a task, the amount of effort used on the task and the persistence in accomplishing the task. Applied to computer self-efficacy, this would suggest that one's choice, effort and persistence in using computer technology is influenced by one's level of computer self-efficacy. Miura's work which analyzed findings drawn from a two-page questionnaire completed by 368 students, showed that students' computer self-efficacy scores have an impact on their behaviour (plans to take further computer courses). The credibility of her findings appears to be enhanced by the size of the sample and the care she took to include students studying in different disciplines.

Miura's work is referenced in articles by Maitland (1996) and Oliver & Shapiro (1993), among others. Maitland contends that computer self-efficacy can be used to explain and predict students' behaviours; Oliver and Shapiro contend that computer self-efficacy can be a reliable indicator of teachers' future activities. While Miura's results may be credible, transferring her findings and using them as proof that teachers are more likely to implement computers into their teaching seems to stretch the research results. Computer self-efficacy scales are good measurements for determining behaviour. However, *what* behaviour computer self-efficacy scales will determine is a very important question. Even with a high computer self-efficacy score, teachers may not necessarily be inclined to implement computers into their teaching. Perhaps they may only be more likely to use computers for personal use. One purpose of this study is to explore the relationship between levels of computer self-efficacy and the integration of computers into classroom teaching.

Selection of a Computer Self-Efficacy Scale

Kinzie and Delcourt (1990) developed two scales, one for measuring Self-Efficacy for Computer Technologies (SCT) and one for measuring Attitudes Toward Computer Technologies (ACT). They argue that self-efficacy is task-specific so they designed a scale with several subscales for the different tasks associated with different software packages. By saying that self-efficacy is task-specific they acknowledge the need to have a computer self-efficacy scale that asks questions specific to teaching with computer technology as well as specific computer tasks. In other words, Kinzie and Delcourt distinguish between the task of using a computer and the task of teaching with the use of a computer.

There are several computer self-efficacy scales. Most begin by listing computer related skills and asking respondents to identify the computer skills that they possess. They then proceed to ask questions of judgment that are used to determine attitudes. Accordingly, it is important for these scales to be changed as often as new technologies emerge or they become outdated. Questioning respondents about older technologies or tasks that are no longer used may not give useful results. Obviously, this supports the need to prepare self-efficacy scales according to Delcourt & Kinzie's recommendations.

The specific computer self-efficacy scale that will be used for this study is an adaptation of one that was developed by Bobbi A. Kerlin of Lakehead University. It was formerly adapted by Kerlin from a scale developed by Peter Eachus and Simon Cassidy of University College Salford. Their scale was developed to evaluate users' beliefs about their abilities to make effective use of computer systems. Kerlin's scale was used to examine the benefits and difficulties people experience when using computers (as it relates to computer self efficacy). The reason for using Kerlin's scale and not the Eachus and Cassidy scale was that there were additional questions on the Kerlin scale that applied directly to this study.

People who score high on the Eachus and Cassidy scale are expressing the belief that they feel competent and confident about using computer systems; they expect to encounter few difficulties and believe they will be successful in what they are trying to achieve (Eachus and Cassidy, 1997, p. 1). The scale was used to test teachers' beliefs in their ability to perform a desired behaviour using a computer. If teachers scored well on the scale, one could presume that the teachers had some experience with computers. Eachus measured the relationship between self-efficacy scores and computer experience. ($r=0.55$, $p<0.001$)

Eachus and Cassidy (1997) used a sample size of 101 to test the validity of his computer-user self-efficacy scale. Preliminary findings suggest that the psychometric properties of the scale reach acceptable levels; reliability as measured by Cronbach's alpha was 0.94, suggesting a high degree of internal consistency. Construct validity was assessed by looking at the relationships between the self-efficacy scores and data measuring computer use.

There does not seem to be any research arguing that computer self-efficacy is not a reliable tool for measuring the likelihood of teachers implementing computers into their teaching. The research on computer self-efficacy relies strongly on the work of Albert Bandura's theories on self-efficacy (see, for example, Delcourt & Kinzie, 1993; Miura, 1987; Maitland, 1996; Oliver & Shapiro, 1993) Although I agree with Bandura's claim that self-efficacy can help determine behaviour, I am still uncertain whether the transfer to computer self-efficacy and implementation of computers into classroom teaching is as tight an argument. I do not feel that there has been sufficient research done in the area. Indicators of computer self-efficacy are said to be reliable in determining if an individual will use a computer again.

Miura (1987) states that self-efficacy concepts are positively related to plans to enrol in a computer science course and experiment with computer programs. While causality cannot be inferred from these relationships, it is reasonable to conclude that those most likely to perceive themselves as efficacious in computer related tasks would be more likely to attempt a computer science class and to persist despite difficulties encountered. Plans to take a course, or intentions to use computers in teaching, even comfort with the integration of computers into teaching are not sufficient as a basis for saying that implementation will actually happen. Other variables will almost certainly enter into teachers' decisions to use the technology. In addressing this issue it is appropriate to see how the integration of technology into teaching relates to the educational change.

Technology and Educational Change

The integration of technology has become a major school reform. There are important connections between technology implementation and the broader field of school improvement and change. The following personal anecdote about technology and change, I believe, links these.

Although, I am constantly changing the software packages that I teach, I am unsure if my classroom teaching is changing, too. If I use computer technology as an instructional tool, am I teaching differently? or am I just using a more technically advanced tool to allow me to do the same things I have always done? For example, when I first began teaching I used a combination of individual-paced modules designed so that students could work on different software packages in their own time. Occasionally, I would bring the students over to one computer and have them watch a demonstration. I would go through the steps to preforming a particular activity, illustrate a few examples and let the students view the results on my monitor. Today, I do the same process but, rather than having students come to view my monitor, I use an LCD (liquid crystal display) that projects the image that is on my computer screen onto the wall. With the new technology, it is much easier for all the students to watch as I do a demonstration. Moreover, it makes my job easier and I am more efficient. However, a significant point which I am trying to establish in this work is the distinction between instructional and classroom uses of technology.

Because I do not believe that technology itself will improve education (or more fundamentally, change it), I tend to be critical of the educational trend that seems to push for the implementation of computer technology into all classrooms. Is the expense of all those computers justifiable? Will educators use the technology to foster higher-order thinking or will they continue to do what they did before? I experience daily the addition of new technology but does it change my teaching or my students' learning? If it does *change* student learning, is it *improving* learning or just doing the same thing in an up-to-date technical environment?

At this point, one might ask, Is the improvement of the technical environment itself sufficient reason to use the new technologies? For example, should you replace slates with paper; carbon paper with zeroxed copies; or super eight video with hand held camcorders; even though they have the same function? An answer to this question, would require an answer to another deeper question: What is the purpose of technical innovation in education? An innovation, by definition must not only do what prior practice does, but what prior practice cannot do. Therefore, it is not simply enough to replace slates with paper; carbon paper with zeroxed copies; or super eight video camera with a hand held camcorder. One must demonstrate how these innovations transcend the limitations or the prior practices.

Accordingly, many authors argue that the integration of technology into education will not have the significant positive impact on learning that is expected unless educators realize the complexity of the issue. There must be an understanding that the integration of technology is not just about computer-literate teachers in high-tech environments. As with any new school reform, how technology is introduced will have major implications for its success (Mann, 1995, p. 1).

Since I teach about specific technologies and the above illustration argues that an LCD is really a presentation tool similar to an overhead or a single monitor, I think it is important to give another illustration of the way in which a technology may not alter the learning that takes place. Miller and Olsen (1995) asked the question: What do we learn from studying capable teachers who are not technologically minded? (p. 74). In one part of their study they found that teachers' prior practices are more influential in determining how technology will be used than the technology itself.

> For example, after observing a grade 1 teacher using a database in a sophisticated manner, we thought a sound case could be made for technology leading the way to her teaching higher-level thinking skills. Upon examining the teacher's prior practice, however, we discovered her frequent use of matrix charts, where children categorized and sorted information in a complex fashion. The type of thinking, fostered routinely by this teacher, turned out to be similar to that required to build and use a computer database. (Miller and Olsen, 1995, p. 75)

Miller and Olsen's primary finding here is the significance of prior practice. However, their work is also consistent with the findings of others who claim that it is the teachers' involvement with the technology that makes the technology valuable or not (see for example, Galligan, 1995; Mann, 1995; and McKenna, 1995). Miller and Olsen (1995) state that they are cautious as to how far one might generalize their findings because they used an intensive case study approach. I feel that this type of research is necessary for those who want to know in what ways technology can be a valuable resource. By closely observing the interactions among teachers, students and the computer technology researchers are more likely to be able to assess the impact that technology can have on learning.

There is a lot of agreement that technology alone will not change education and that teachers juggle a lot of variables in their decision to use computers in their teaching. (See for example, Fullan et al., 1992; McKenna, 1995; Kraus and Kraus, 1995; and Galligan, 1995). Much of literature demands an exploration into the effect of technology on schooling. Fullan's (1992) work, in particular, would be fundamental to any dissertation which deals with significant educational change but a consideration of the implications of his views is particularly facilitated by the fact that he has used a Canadian attempt to implement the widespread use of computers in schools as a case study to illustrate the issues involved in the implementation of any major educational innovation (Drury, 1995, p. 1).

> Implementing microcomputers in schools contains all that is fascinating in education change: intuitive attraction and great uncertainty; excitement and hardship; enthusiasms and exhaustion; visibility and high public interest combined with unknown results. (Fullan, 1992, p. 28)

It is understandable that getting computers into the classroom and getting teachers in-serviced about their use would be the initial goals of many technology plans; however, this is a limited vision of what it takes to create change. Some of the literature on technology integration attempts to identify certain factors that can affect a teacher's decision to integrate computers into the classroom. Unfortunately, the isolation of specific variables as the key to the successful integration of technology into the classroom and ultimately the change in teaching practice, negates the views of those who argue that the integration of technology into teaching is such a complex reform issue.

As Kraus (1995) states, since the advent of the computer age teacher training institutions began to look to this new technology and to consider ways in which various aspects of educational technology could be integrated into their curriculum. However, technology as a whole has not met many of the high expectations first placed upon it. Kraus states that researchers have reported that simply providing computers in the education setting is not enough. By illustrating that the integration of computer technology is a complex change issue, much of what has been presented in the previous pages supports the thesis that CSE alone may not alone be enough to change classroom practice.

Factors that Influence Adoption

This section will explore the literature on technology integration and try to identify other key areas that have been observed to affect teachers' implementation of computers into their classrooms.

Several factors are considered to have an impact on teachers' willingness and ability to adopt computer usage in their teaching. Common factors include attitudes of student and faculty, ages of faculty, length of service and the technological orientation of their discipline (Hirschbuhl and Faseyitan, 1994).

Some authors identify other reasons for computer use that are not specific only to teachers. Rosen & Weil (1990) note that efforts to identify the key features that limit use of computers have not been inclusive. Jones (1994) states that attempts to identify variables that predict attitudes towards computers and probable computer use have included some attention to the cognitive style construct. In his study, Jones found a relationship between style preference and selected computer use. His study sample consisted of 140 education students using the Meyers Briggs Type Indicator test and a probability of computer use scale adapted from Kaye (1989). Jones' sample of 140 *education* students could be thought of as biased. However, because he found all cognitive styles present and he was looking at the correlation between cognitive style and computer use, I think his results are credible.

Jones' research suggests the possibility that teachers' cognitive learning style may have an impact on computer use and, ultimately, the implementation of technology into their teaching. Certain teachers may not value computer instruction and, therefore, would not be inclined to implement computers into their instruction. Unfortunately, even if this is the case, most teachers in Alberta today do not have the luxury of deciding *whether or not* to implement. Rather they are being forced (or guided) to decide *how* they are going to implement the technology into their teaching. This, as discussed earlier, is inconsistent with the views of those who argue that the successful integration of school reforms cannot be mandated from above.

If a moderate-to-high level of computer self-efficacy is necessary but not sufficient for the integration of technology into classroom teaching, then there must be other conditions which can influence adoption. While teachers may have to have experienced a particular software program, they may not need moderate-to-high levels of computer self-efficacy to implement that technology into their teaching. For example, an English teacher can tell all of his/her grade seven students that they must word-process their short stories, using pagination, appropriate line spacing and page margins. Within such an environment, the assigning teacher may not have to be literate in the computer technology, if such information is being taught by another teacher or being learned in another context. Similarly, a grade three teacher who uses skill and drill software to aid students' understanding of math concepts need not be computer literate. This teacher needs to understand *how to use* the software programs as a teaching tool not how to use the computer itself.

According to Wetzel & Chisholm (1996) most technology instruction in Colleges of Education involves teaching about technology as a separate subject, not teaching with technology by integrating it into other course work to provide a model for instructional use. Teaching about technology is different from teaching for the implementation of computers into teaching. I think it is safe to say that more and more people, including teachers, are becoming more computer literate. However, I don't think that this transfers into more and more teachers implementing computers into their teaching. If teachers are graduating from teacher preparation programs with limited knowledge of the ways to integrate technology into their teaching, then perhaps again, moderate-to-high levels of computer self-efficacy are necessary yet not sufficient to enable or encourage teachers to undertake the implementation of computers into classroom teaching. Clearly a rapidly changing technological environment would be the perfect place in which to teach teachers how to deal with and be critical of change. It is equally clear, however, that the acquisition of computer *skills* is only one aspect of the change process.

CHAPTER III

METHODOLOGY

Sample

Ninety-five surveys (see Appendix A) were sent to teachers in 19 schools in Lethbridge and area. The schools were selected randomly from the telephone book. The sample consisted of nine elementary schools, two K-9 schools, three junior high schools and four high schools. Five surveys were delivered to each school after initial contact with school administration. By filling out the survey teachers were giving their consent to participate in this study.

In most cases, the administrators distributed the surveys to their teachers. The administrators were asked to choose randomly from their staff with the exception that Career and Technology Studies (CTS) teachers were not to be included in the study sample. I felt that CTS teachers would strongly bias the results because they teach about computers and, most often, they teach with computers in most of their courses.

Response Rate. Eighty-seven out of ninety-five of the teachers surveyed responded (92%). Although I was personally satisfied with this response, I felt that the response illustrated the interest teachers have in this area of study--an interest that may stem from knowledge, lack of knowledge or fear about technology integration in schools.

Collection of Survey Data

The answer to each question on the survey was given a score ranging from one to six depending on the respondents answer. For example, in responding to question 27: *I find working with computers very frustrating*, respondents would be given 6 for strongly agree and 1 for strongly disagree. However, in responding to question 13: *I find it difficult to get computers to do what I want them to,* respondents would be given 1 for strongly agree and 6 for strongly disagree (the opposite of the numbers on the survey). This allowed me to tabulate a final CSE score for each respondent and place their scores on a scale--the higher the score the higher the degree of confidence and skill in using the computer.

After tabulating all CSE scores, I checked for the types of computer uses that the respondents identified. All specific uses are listed in the tables in chapter four. The purpose of these is to show how the CSE scores correlate with classroom practice.

Measuring Correlations

Since the purpose of this work is to explore the relationship between CSE and classroom practice, I needed to use a statistical measurement that would allow me to measure the relationship between the two variables. Simple linear regression analysis allowed me to identify the correlation coefficient of the two variables by using the formula, $r = b * (S_x/S_y)$.

Delimitations and Limitations of the Study

While conducting this research I was called to answer the question, *How generalizable are these results?* Because of the errors associated with sampling versus census research, the following needs to be discussed. I randomly selected schools from the Lethbridge and area telephone directory. I tried to select an equal amount of schools from all grade levels. However, there are far more elementary and junior high schools than senior high schools.

"The sampling error occurs by chance, and cannot be avoided" (Mann, 1995, p. 715). In other words, there may be error in the research because by chance I did not survey a correct sample. There are also non-sampling errors. These include:

a. The respondent may intentionally or unintentionally give false information.

b. The researcher may have made a mistake in recording data.

c. The questions may have been unclear to the respondent.

I was careful to avoid 'b' and had no control over 'a'. However, 'c' was a concern for this study. In particular, some of the respondents highlighted (underscored, circled etc.) the word require, in the following statement: *I require my students to use computers for the following.* Selecting the word require may not have been the best choice.

There were other ways in which this research could have been improved or refined. Some issues that were not addressed by the survey were as follows: the number of times teachers used a specific task (in a day, week or course); the number of computers available; the quality and type of hardware and software used; and the specific exercise that was given. Some of these clarifications of 'classroom use' and 'instructional use' may have given a clearer picture of what it actually means to *integrate computers into classroom teaching*. The next chapter provides the summary of the data collected.

CHAPTER IV

RESULTS

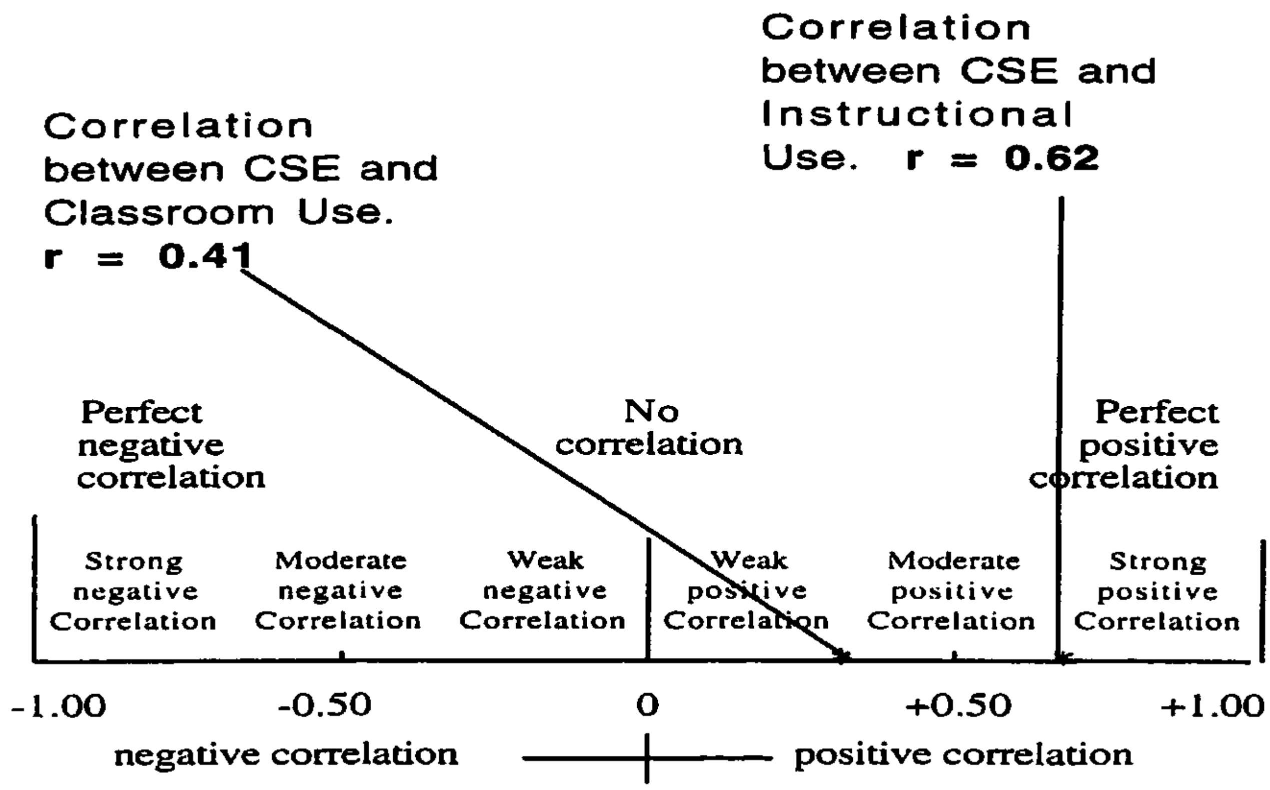
This chapter identifies and explains correlation coefficient as the statistical measure used to explore the data. The relationship between CSE and both classroom and instructional uses are discussed and the significant observations of these are reported. As well, I address the relevance of computer training courses as they apply to this work.

Interpretation of the Data

Ninety-two percent of the surveys were returned (87/95). The data showed that there was not a strong correlation between computer self-efficacy scores and classroom practice (See Table 4.1 and 4.2). The formula used to compute the correlation was the simple linear regression model, $r = b * (S_x/S_y)$. A positive correlation would result in a correlation coefficient close to one. A negative correlation would result in a correlation coefficient close to minus one (Mason and Lind, 1993). The computation of the correlation coefficient resulted in an 'r' value of 0.40550708. (See Table 4.1 and Table 4.2) This correlation coefficient is not considered a strong correlation in statistical discussions. A correlation coefficient is beginning to get closer to a meaningful correlation when the 'r' value gets closer to the range .65 - .80 (Mason and Lind, 1993). The following diagram illustrates this point more clearly.

Correlation Analysis

Table 4.1
Correlation Analysis Grid



(Mason & Lind, 1993, p. 469)

Even a large correlation coefficient does not necessarily mean that one (variable) is the cause of another (Norusis, p. 400). For example, if there is a strong correlation between the ounces of coffee consumed in a day and the salary of the consuming individual, it should not be concluded that drinking more coffee will increase one's salary.

Both 'r' and 'r^2' are useful in determining correlational analysis (Norusis, p. 403). r^2 tells us what proportion of the variability of the dependent variable is explained by the regression model. If r = 0.40550708, then r^2 = 0.164436. This shows that 0.164436 or 16 percent of the variation of classroom use is explained by computer self-efficacy scores, and 84 percent of the variation is not explained by CSE scores. This supports the contention that there are other factors that affect teachers' adoption of computers into their classroom practice. In fact, this study shows that 84 percent of the variation needs to be explained by other factors.

Table 4.2
Correlation Coefficient Chart

Regression Output: FOR CLASSROOM USE	
R Squared	*0.1644362*
No. Of Observations	87
Degrees of Freedom	85
r=	*0.4055074*

Table 4.2
Correlation Coefficient Chart, Con't

Regression Output: FOR INSTRUCTIONS USE	
R Squared	*0.3821783*
No. Of Observations	87
Degrees of Freedom	85
r=	*0.6182057*

The 'r' factor for the correlation between CSE and instructional use is greater than the 'r' factor for CSE and classroom use. For instructional use, r = 0.6182057 (See Table 4.2). The correlation analysis guide in Table 4.1, shows that the correlation between CSE and instructional use falls between the range of moderate to strong correlation. This confirms the need to distinguish between computer use in the two areas of teaching.

Table 4.3 identifies the CSE scores of each respondent and specific classroom computer uses that they employ. The information from each respondent was put in numeric order based on the score from their computer self-efficacy scale results to allow the reader to interpret the information more easily. The scores are calculated by adding the answers to all 29 questions. When all questions are answered, 174 is the highest possible score (6 for each answer of the 29 questions) and 29 is the lowest possible score (1 for each of the 29 questions answered). Scores above 116 indicate that a teacher has responded, on average, with a 4 out of 6 on the Likert scale. Accordingly, a CSE score of 116 is slightly above average. The following CSE scores have been calculated to give the reader a guideline for understanding the scores:

Average Response (out of 6)	Calculated CSE Score
1	29
2	58
3	87
4	116
5	145
6	178

Table 4.3 CSE Scores and Comparative Classroom Practice

CSE Score	*Writing Assignments*	*Engaging in Research*	*Solving Problems*	*Developing Presentations*	*Completing Assignments*	*Communicating With Students in School*	*Communicating With Students Outside of School*	*Other Specify*	*Total Classroom*	*Computer Training Course*	*Grades Taught*
43	0	0	0	0	0	0	0	0	0	1	4-6
51	0	0	0	0	0	0	0	0	0	1	K - 3
59	0	0	0	0	0	0	0	0	0	1	K - 3
72	0	1	1	0	0	0	0	0	2	1	K - 3
73	1	1	0	1	1	0	0	0	4	1	10-12
73	1	1	0	0	1	0	0	0	3	1	4-6
78	0	0	0	0	0	0	0	0	0	1	4-6
80	0	1	0	0	0	0	0	0	1	0	4-6
86	0	0	0	0	0	0	0	0	0	1	7-12
87	1	0	0	0	1	0	0	0	2	1	4-6
90	1	1	0	0	0	0	1	0	3	1	4-6
90	0	1	0	0	0	0	0	0	1	1	7-9
93	1	1	1	0	0	0	0	0	3	1	7-9
93	0	0	1	0	0	0	0	0	1	1	K - 3
94	1	1	0	1	1	0	0	0	4	0	4-6
94	0	0	0	0	0	0	0	0	0	1	7-9
95	1	1	0	1	1	0	0	0	4	1	10-12
96	0	0	0	0	0	0	0	1	1	0	K - 3
97	0	0	0	0	0	0	0	0	0	1	K - 3
98	0	1	0	0	0	0	0	0	1	1	K - 6
99	1	1	0	0	0	0	0	0	2	1	4-6
101	0	0	0	0	0	0	0	0	0	1	10-12
101	0	0	0	0	0	0	0	0	0	0	7-9
103	1	0	0	1	0	0	1	0	3	0	4-6
104	0	0	1	0	0	0	0	0	1	1	K - 6
104	1	0	0	1	0	0	0	0	2	0	10-12
106	1	1	1	0	0	0	0	0	3	1	K - 3
106	0	0	0	0	0	0	0	1	1	1	K - 3
108	0	0	0	0	0	0	0	0	0	1	7-9
108	0	0	0	0	0	0	0	0	0	1	10-12

continued...

Table 4.3 CSE Scores and Comparative Classroom Practice (Continued)

CSE Score	Writing Assignments	Engaging in Research	Solving Problems	Developing Presentations	Completing Assignments	Communicating With Students in School	Communicating With Students Outside of School	Other Specify	Total Classroom	Computer Training Course	Grades Taught
113	0	0	1	0	0	0	0	1	2	1	K - 3
114	1	1	0	0	0	0	0	0	2	1	4-6
114	1	0	0	1	0	0	0	0	2	1	10-12
115	0	0	0	0	0	0	1	0	1	1	4-6
115	0	0	0	0	0	0	0	0	0	0	7-9
117	0	0	0	0	0	0	0	0	0	1	7-9
118	1	1	0	0	1	0	0	0	3	1	7-9
119	0	0	0	0	0	0	0	0	0	1	10-12
121	1	1	0	0	1	0	0	0	3	1	10-12
123	0	1	0	0	1	0	0	0	2	0	10-12
123	1	1	0	0	0	1	1	0	4	1	4-6
124	1	1	1	0	0	0	0	0	3	1	K - 3
125	0	0	0	0	0	0	0	1	1	1	4-6
126	1	1	0	0	0	0	0	0	2	1	K - 3
126	1	1	0	0	1	0	0	0	3	1	4-6
126	1	1	0	1	0	0	0	0	3	1	10-12
129	1	0	1	0	0	0	1	0	3	1	4-6
130	0	0	0	0	0	0	0	0	0	1	10-12
130	1	0	0	0	0	0	0	0	4	1	4-6
131	0	0	0	0	0	0	0	0	0	1	K - 3
132	1	0	0	0	0	0	0	0	1	0	7-9
132	1	1	1	0	0	0	0	0	3	0	4-6
133	1	0	0	1	1	0	0	0	3	1	7-9
133	0	1	0	0	0	0	0	0	1	1	7-9
134	1	1	0	0	0	0	0	0	2	1	K - 3
134	1	1	1	0	1	1	1	0	6	1	4-6
136	0	0	0	0	0	0	1	1	2	1	10-12
137	0	1	0	0	1	0	0	0	2	0	10-12
138	1	1	1	0	0	1	0	0	4	1	4-6
139	0	1	0	0	0	0	0	0	1	1	K - 6

continued...

Table 4.3 CSE Scores and Comparative Classroom Practice (Continued)

CSE Score	*Writing Assignments*	*Engaging in Research*	*Solving Problems*	*Developing Presentations*	*Completing Assignments*	*Communicating With Students in School*	*Communicating With Students Outside of School*	*Other Specify*	*Total Classroom*	*Computer Training Course*	*Grades Taught*
140	1	0	1	1	0	1	1	0	5	1	4-6
142	1	1	0	0	0	0	0	0	2	0	K - 6
142	1	1	0	1	0	0	0	0	3	1	4-9
143	1	1	1	1	0	0	0	1	5	1	K - 3
143	0	0	0	0	0	0	0	1	1	1	K - 3
144	0	1	1	0	0	1	1	0	4	1	K - 6
144	1	0	0	0	0	0	0	0	1	1	4-6
146	0	1	0	0	0	0	0	0	1	1	4-6
148	1	1	1	1	0	0	1	0	5	1	4-6
149	0	0	0	1	1	0	0	1	3	1	7-12
149	1	0	0	1	1	0	0	0	3	1	7-9
149	1	1	0	1	0	0	0	1	4	1	10-12
150	1	1	0	0	0	0	1	1	4	1	4-6
150	0	0	1	1	1	0	0	0	3	0	7-9
151	1	1	1	1	1	0	1	0	6	1	7-9
152	0	0	1	0	1	0	0	0	2	1	10-12
152	0	0	0	0	0	0	0	0	0	1	10-12
155	1	1	0	0	1	0	0	0	3	1	10-12
157	1	0	0	0	0	0	1	0	2	1	4-6
157	0	1	0	1	0	0	0	0	2	1	10-12
161	0	1	1	0	0	0	0	1	3	1	K - 3
163	1	1	0	0	0	1	1	0	4	1	K - 3
164	0	0	0	0	0	0	0	0	0	1	7-9
165	0	0	1	1	0	0	0	1	3	1	K - 3
166	1	1	0	0	0	0	0	0	2	1	K - 3
168	1	1	0	1	0	0	1	0	4	0	7-9
171	1	1	1	1	1	1	1	0	7	1	4-6
Total Teachers Using Specific Practice	44	44	21	21	19	[illegible]	16	12		73	
Percentage of Total Teachers Surveyed	51.16%	51.16%	24.42%	24.42%	22.09%	8.14%	18.60%	13.95%		84.88%	

Table 4.4

Computer Training Courses and Classroom Practice

	Number of Teachers (n = 87)	Respondents Identifying No Classroom Use	Respondents Identifying Classroom Use	Average Number of Classroom uses
Attended Computer Training Course	73	16/73	57/73	2.30
Not Attended any Computer Training Course	14	2/14	12/14	2.33

From Table 4.4, it can be seen that 74/87 (85%) teachers have attended a computer training course, while 69/87 (79%) have their students use the computer in the classroom for at least one task. The most common tasks performed by students in the classroom are 'writing assignments' and 'engaging in research' (see Table 4.3). Both of these activities are used by 44/87 (51%) of the teachers surveyed.

Each of the classroom uses listed on the survey is used by teachers with both low and high CSE scores. For example, having students use the computer for 'engaging in research' is reported by respondents whose scores were as low as 72 and 73 and by others whose scores were as high as 168 and 171. The one exception to this was found in the task of 'communicating with students in school.' The respondent with the lowest CSE score who had students communicate electronically had a score of 123. Interestingly, this task had one of the highest correlations with CSE. The following calculations illustrate this more clearly:

SPECIFIC CLASSROOM TASKS
AND THEIR CORRELATION WITH CSE

Task	***Correlation Coefficient (r =)***
Completing Assignments	0.077
Engaging in Research	0.171
Solving Problems	0.196
Writing Assignments	0.205
Communicating with Students in School	0.240*
Developing Presentations	0.254
Communicating with Students Outside of School	0.287

* Classroom task with the lowest corresponding CSE score of 123

The fact that this task had no corresponding CSE scores less than 123 might be explained by at least two factors: firstly, the schools may not have the necessary technology; and secondly, those teachers who consider themselves to be less skilled in computer technology are less inclined to ask for new or specific technologies. In other words, typically, teachers who have shown a willingness or expertise in an area have been rewarded with greater access to the better or newer technologies. In this way, the idea that teachers have to be computer literate to teach with computers can be manifested by an unspoken protocol. Aside from this one instance, the other seven different classroom uses listed on survey were indicated by teachers with all levels of CSE. This seems to indicate that CSE is not related to classroom practice.

Surprisingly, 12/18 (67%) of the teachers surveyed who do not use computers in their classroom teaching, teach grades 7-12 (6 teach grades 7-9; 1 teaches grades 7-12; and 5 teach grades 10-12), yet these high school teachers comprise only 35/87 (40%) of the surveys returned. The CSE scores of these teachers ranged from 86 to 164. This leads to the conclusion that alone, CSE scores, cannot be used to predict classroom practice.

Thirty-four percent of the grade 7-12 teachers (12/35) do not use computers in their classroom teaching, while only 15 percent of k-6 teachers are not using computers in the classroom. I found these results surprising, because typically junior and senior high schools have had better access to newer technologies. As well, they often have subject-specific computer teachers who are highly-skilled in technology. Before this study, I would have considered those teachers who are highly-skilled in computers more able to aid and encourage other teachers with integrating computers into their own classroom practice. This finding further reinforces the point that teaching *about* or *for* technology (for example, those teachers who teach computers in grades 7, 8, 9 10, 11 or 12) is quite different from teaching with technology.

Table 4.5 identifies the CSE score of each respondent and the specific instructional computer uses that they employ. While 79 percent of teachers use computers for classroom uses, 91 percent of the teachers surveyed use computers for instructional uses. This is a key difference and shows that more teachers are using computers for instructional purposes than for classroom teaching. As well, those teachers who are using computers in the classroom are, on average, using the computer in 2.7 different ways, whereas those teachers who are using the computer for instructional uses, are on average, using them in 5.2 different ways.

Table 4.5 CSE Scores and Comparative Instructional Practice

CSE Score	Student Marks	Course Outlines	Test Development	Yearly Professional Development Plans	Instructional Plans	Lesson Plans	Student Exercises	E-Mail Outside Classroom	E-mail for Communication With Other Educators	Other Specify	Instructional Total
43	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0
72	0	0	0	0	0	0	0	0	0	0	0
73	0	1	1	0	1	0	0	0	0	0	3
73	0	0	1	1	1	1	0	1	0	0	5
78	1	1	1	0	0	0	0	1	1	0	5
80	0	0	0	0	0	0	0	0	0	0	0
86	1	1	1	1	0	0	0	0	1	1	6
87	0	0	1	0	1	1	1	0	1	0	5
90	0	1	1	0	1	0	0	0	0	0	3
90	1	1	1	1	1	1	0	0	0	0	6
93	0	1	1	0	0	0	0	0	0	0	2
93	0	0	0	0	1	0	0	0	1	1	3
94	0	0	1	0	0	1	0	0	0	0	2
94	1	1	1	1	1	0	0	1	1	0	7
95	1	1	0	0	0	1	0	1	1	0	5
96	0	0	0	0	0	0	0	0	0	1	1
97	0	0	0	0	0	0	0	0	0	0	0
98	0	0	1	0	0	0	0	1	0	0	2
99	0	0	1	0	0	0	1	1	1	1	5
101	0	1	1	0	1	0	0	1	0	0	4
101	0	1	1	1	1	1	0	0	0	0	5
103	0	0	1	1	0	0	1	1	1	0	5

continued...

Table 4.5 CSE Scores and Comparative Instructional Practice (Continued)

CSE Score	Student Marks	Course Outlines	Test Development	Yearly Professional Development Plans	Instructional Plans	Lesson Plans	Student Exercises	E-Mail Outside Classroom	E-mail for Communication With Other Educators	Other Specify	Instructional Total
104	1	1	1	1	1	1	0	0	1	0	7
104	1	1	0	0	0	0	0	1	1	0	4
106	0	0	0	1	1	0	0	0	0	0	2
106	0	0	1	1	0	0	0	1	1	1	5
108	0	1	0	0	0	0	0	0	0	0	1
108	1	0	0	0	0	0	0	1	1	0	3
113	0	0	0	0	0	0	0	0	0	0	0
114	0	0	1	0	0	0	0	0	0	0	1
114	0	1	1	0	0	1	1	0	0	0	4
115	0	1	1	1	0	0	0	1	1	0	5
115	1	1	1	0	1	0	0	0	0	1	5
117	1	0	0	0	0	1	0	0	0	0	2
118	0	1	1	0	1	0	0	0	1	0	4
119	0	1	1	0	1	0	0	1	0	0	4
121	1	0	0	0	0	1	1	0	1	0	4
123	0	1	1	1	1	0	0	0	0	0	4
123	1	0	1	0	1	0	0	0	1	0	4
124	0	1	1	1	1	0	0	0	1	0	5
125	0	0	0	0	1	0	1	0	0	0	2
126	1	1	1	1	1	0	0	0	0	0	5
126	1	1	1	1	1	1	0	0	0	0	6
126	1	1	1	1	1	0	0	0	1	0	6
129	0	0	0	0	1	0	0	0	1	0	2
130	1	1	1	1	0	0	1	0	0	0	5

continued...

Table 4.5 CSE Scores and Comparative Instructional Practice (Continued)

CSE Score	Student Marks	Course Outlines	Test Development	Yearly Professional Development Plans	Instructional Plans	Lesson Plans	Student Exercises	E-Mail Outside Classroom	E-mail for Communication With Other Educators	Other Specify	Instructional Total
130	0	0	1	0	0	1	0	1	1	0	4
131	0	0	0	0	0	0	0	0	0	0	0
132	0	1	1	0	1	0	0	0	0	0	3
132	1	0	1	0	0	0	0	0	0	0	2
133	1	1	1	1	1	0	1	1	1	0	8
133	1	1	1	0	0	0	0	0	1	0	4
134	0	0	0	0	1	1	0	0	1	0	3
134	0	1	1	1	1	1	1	1	1	0	8
136	1	1	1	1	1	1	1	1	1	1	10
137	1	1	1	1	1	0	0	1	1	1	8
138	1	1	1	1	1	1	0	1	1	0	8
139	0	1	1	1	1	0	0	1	1	0	6
140	1	1	0	1	1	1	1	1	1	0	8
142	0	1	1	1	1	0	0	1	0	1	6
142	1	1	1	1	1	1	0	0	1	1	8
143	0	1	1	1	1	1	1	0	1	0	7
143	0	0	0	0	0	0	0	0	1	1	2
144	1	1	1	1	1	0	0	1	1	0	7
144	0	1	1	0	0	0	0	1	0	1	4
146	1	1	1	0	1	0	1	1	1	0	7
148	0	1	1	1	1	1	1	1	1	0	8
149	1	1	1	1	1	1	0	0	0	1	7
149	0	1	1	1	0	0	1	0	0	0	4
149	1	1	1	1	1	1	0	1	1	1	9

continued...

Table 4.5 CSE Scores and Comparative Instructional Practice (Continued)

CSE Score	Student Marks	Course Outlines	Test Development	Yearly Professional Development Plans	Instructional Plans	Lesson Plans	Student Exercises	E-Mail Outside Classroom	E-mail for Communication With Other Educators	Other Specify	Instructional Total
150	0	1	1	1	1	1	1	0	1	0	7
150	1	1	1	1	1	1	0	0	0	0	6
151	1	1	1	0	1	1	1	1	0	1	8
152	0	1	1	1	1	1	1	0	0	0	6
152	1	1	1	1	1	0	1	1	1	0	8
155	1	1	1	0	1	1	1	0	1	0	7
157	0	1	1	1	1	0	0	1	1	0	6
157	1	1	1	0	0	0	0	1	1	1	6
161	0	0	0	1	1	1	0	1	0	1	5
163	0	0	0	1	1	1	0	1	1	0	5
164	1	1	1	1	1	1	1	1	1	0	9
165	0	1	0	1	1	0	0	1	1	1	6
166	1	1	1	1	1	1	1	1	1	0	9
168	1	0	1	1	1	0	0	1	1	1	7
171	1	1	1	1	1	0	1	1	1	1	9
Teachers Using Specific Practice	37	55	62	43	53	31	23	38	47	20	92% (87/95) of teachers surveyed use computers for instructional purposes
Percentage of Total Teachers Surveyed	43.0%	64.0%	72.1%	50.0%	61.6%	36.0%	26.7%	44.2%	54.7%	23.3%	

Not only are more teachers using computers for instructional purposes but they are also using the computer in a greater number of ways for instructional uses than they are for classroom uses. This finding highlights the need to separate teachers' use of computers into classroom and instructional uses.

The information contained in Table 4.5 further shows that none of the specific instructional uses seem to be dependent on CSE scores. Each instructional use listed on the survey is reported by individuals with varying CSE scores. For example, 'test development' is utilized by respondents with scores varying from 73 to 171.

Figure 4.1 is a visual representation of the data in Table 4.3. It identifies the teachers' CSE scores and the corresponding number of different classroom computer activities each teacher used. The purpose of the visual representation is to allow the reader to see that the number of different classroom uses varies inconsistently with CSE score.

Figure 4.1 CSE Scores and Total Classroom Uses

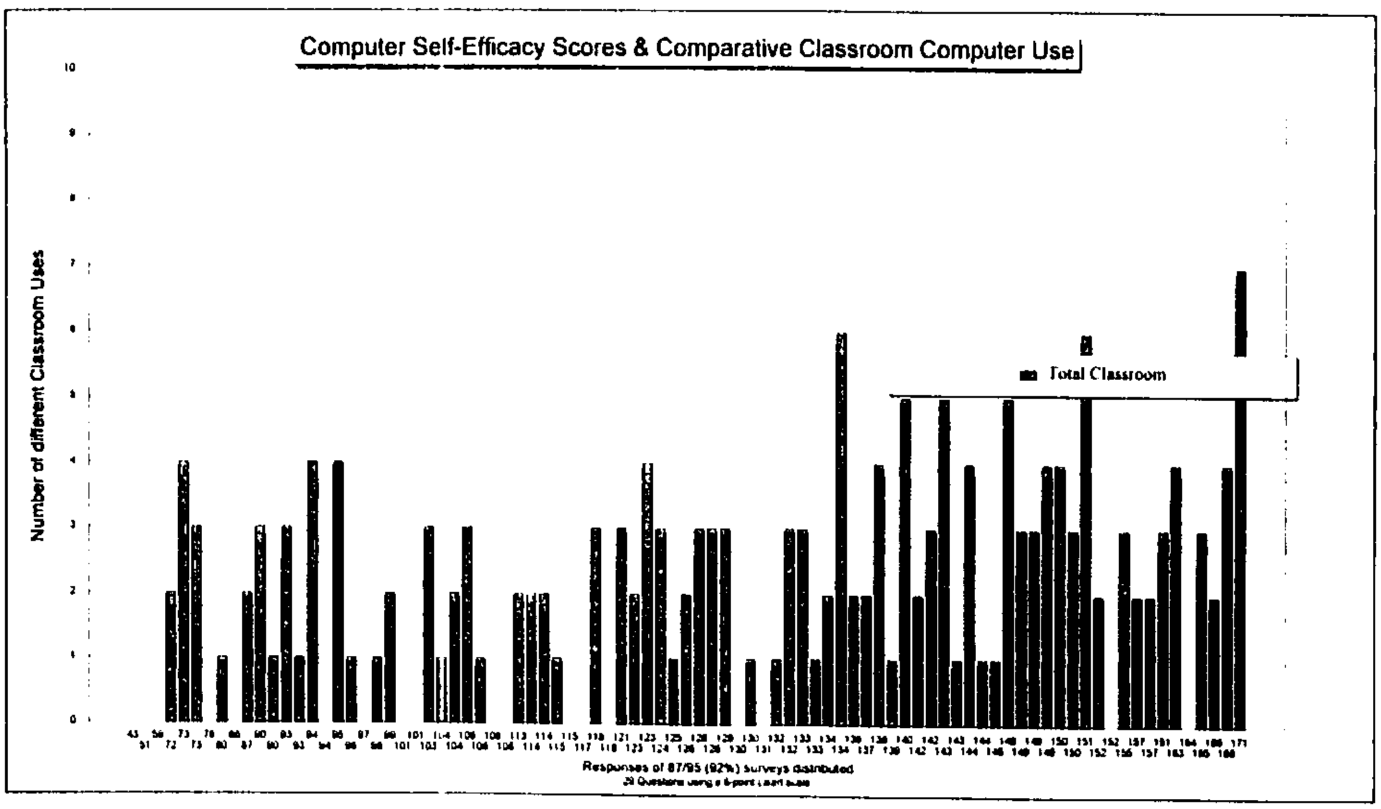
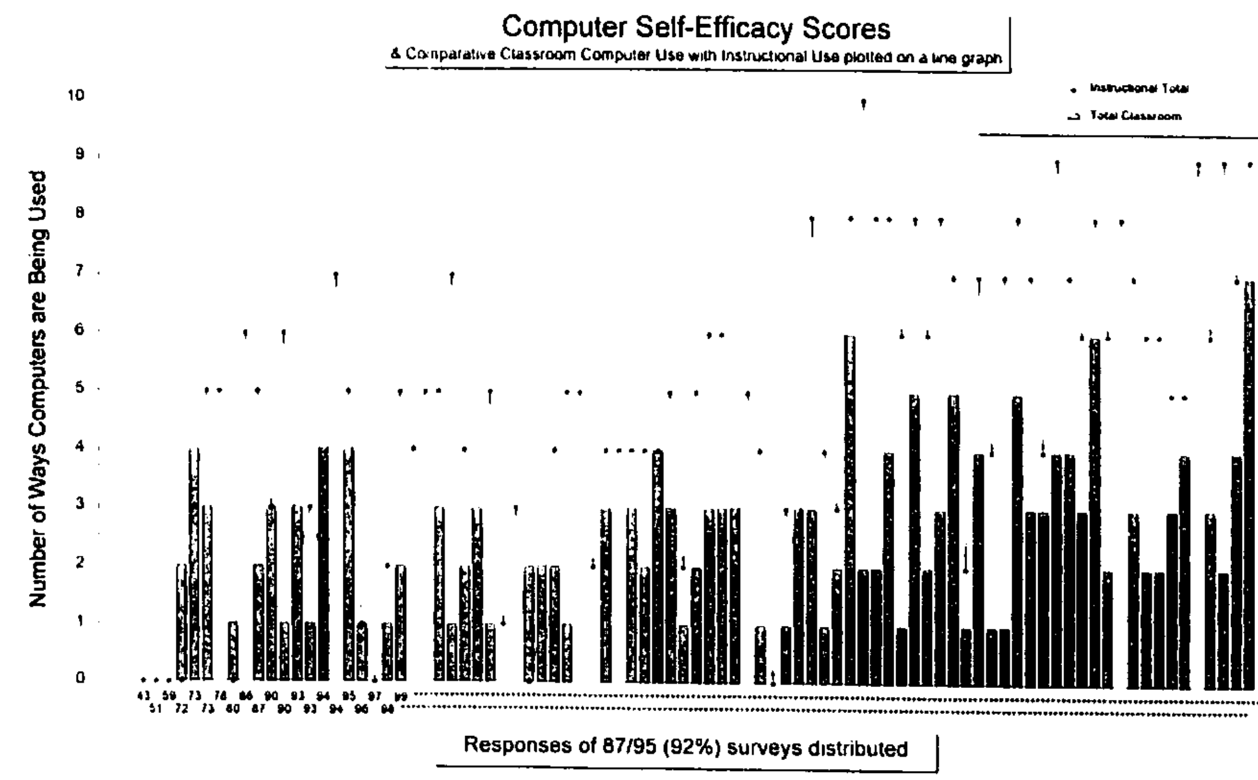


Figure 4.2 allows the reader to view CSE scores, the number of different classroom computer activities each teacher uses AND the line plotting the number of instructional computer activities the teacher utilizes. This graph illustrates the greater consistency between higher CSE scores and more computer usage. The important points illustrated in this graph are that (1) people with higher CSE scores use a computer more often, and (2) the type of computer activity that teachers with higher levels of CSE engage in should be separated into classroom and instructional use. When computer usage is divided into the two teaching areas a more accurate picture of how specific computer technology is being used in education can be presented.

In summary, this research strives to demonstrate that teachers who are computer literate (as illustrated by a high CSE score) do not necessarily use computers in their classroom teaching. On the other hand, some teachers with low CSE scores teach with computers in their classrooms. These findings clearly show that computer expertise is neither sufficient nor necessary for the integration of computers into classroom practice. This has significant implications for classroom practice, professional development and teacher training as developed in the next chapter.

Figure 4.2 CSE Scores and Total Classroom and Instructional Uses



CHAPTER V

DISCUSSION AND IMPLICATIONS

The results of this study should be important considering how much time and money schools spend training teachers in specific computer technologies. As one example, if those teachers with higher CSE are not integrating the computer technology into their classroom practice, perhaps school boards should not be spending time and money training their teachers in computer technology. This chapter provides insights into the possible implications of this research for classroom practice, professional development and teacher education.

Implications for Classroom Practice

Kowalski (1988) provides an attractive example of attitudes towards new technologies and their comparative impact on education. In talking about the invention of the motion picture, Edison is quoted in saying,

> Books will soon be obsolete in our schools. Scholars will soon be instructed through the eye. It is possible to teach every branch of human knowledge with the new technology. Our school system will be completely changed in ten years. (Thomas Alva Edison as quoted by Kowalski, p 1.)

Today, we can see that the effects on education of both motion pictures and television were not as dramatic as expected. A similar debate is heard with respect to the use of computers in education, especially in the area of communications technology. Unfortunately, we do not have the luxury of looking back 80 years and deciding whether or not computers actually had such a significant impact on teaching. As well, we are moving so quickly that we must decide, now, how computers will affect classroom practice and what skills teachers will need to use new technologies effectively as instructional and teaching tools.

The change literature described earlier in this work makes it easier to understand why the motion picture did not change education as expected. Some technology that can be used as a teaching tool may not in itself change teaching and learning. LCD's, presentation software or marks programs are current examples of technologies that may aid the teacher but do not have a significant impact on student learning. Because of this, these types of computer uses are listed in the instructional section of the survey. These technologies are different from computer technologies that are used in classroom practice with the intent of improving student learning—such things as math tutorials or statistics programs designed to allow students to quickly view a variety of scenarios. These types of programs are expected to improve learning because they accommodate a variety of learning styles, provide immediate feedback or can be used to identify and improve individual student needs. The distinction between these two areas of educational technologies is important for understanding the overall focus of this project. By identifying specific uses as instructional and classroom, this study makes it easier to see what part CSE scores play in determining teachers' classroom practice. The data graphed in figure 4.5 illustrates how the teachers use the computer more often for instructional purposes. If the teachers' activities were not separated into instructional and classroom uses, an accurate picture of what was happening in the classroom would not result. Moreover, by studying figure 4.2 and reviewing the information obtained from Table 4.5, the reader can see that instructional uses increase with higher CSE scores. As noted earlier, CSE scores and instructional uses have a moderate to strong correlation. Therefore, if the distinction between the two teaching activities had not been made, the results may have been less accurate.

Table 4.3 shows that all of the classroom computer uses listed in the survey were utilized by teachers with low, moderate and high CSE scores. I think this illustrates that the computer is a tool that teachers can utilize to enhance their teaching regardless of their skill at using the computer. For teachers, this means they must be aware of the vast array of technology available and they must be able to identify when it is suitable to use which technology in their classes. For example, a teacher cannot expect a class of students to work in a complex software program if they do not know the basics of working at a computer. As another example, the literacy levels required to effectively use search engines on the Internet are such that most primary school students might not benefit from using them. For teachers, this means that they need to be able to identify age and subject appropriate software, as well as determine what computer skills are needed to run specific software packages. For example, while allowing students to access resources on the Internet for school activities, teachers need to be aware that the students' ability to make critical judgements about what they read may be more important than their ability to use a mouse. If the students have the computer skills necessary to work on the Internet, teachers should probably ask a further question: Do my students have the intellectual ability and maturity to handle the amount of information accessible on the Internet?

Available technology and high levels of computer literacy together are not enough to change teachers classroom practice. This point becomes obvious when teachers who are not computer literate are using computers in their classroom teaching. Evidence of both these findings are offered in Table 4.3 and Table 4.5 where the specific CSE scores and instructional and classroom computer uses are listed.

The integration of computer technology as a school reform is made more difficult because of its constantly changing nature. Those teachers who seek to integrate computers into their classroom practice may be more able to do so by collaborating with other teachers, observing successful integration, and by exploring teaching methods associated with its integration. As new computer technology emerges, it is reasonable to expect that the ways in which this technology is used should become more diverse. Viewed in this light, one of the major implications of this research for classroom practice should be teachers' openness to and interest in developing and perfecting the variety of teaching methods needed to integrate computer technology into the classroom--not skill in the emerging technology, as such, but skill in the teaching methods associated with its use in the classroom. The average number of different instructional uses employed by the teachers was 5.2 while the average number of classroom uses was 2.7. This demonstrates that teachers are not integrating technology into their classroom teaching in as many ways as there are existing technologies or in as many different ways as they are using it for instructional purposes. This seems to support the conclusion that teachers' skill in using a particular technology does not imply teachers' ability or willingness to teach with it.

Implications for Professional Development

The results of this study clearly have a bearing on professional development. First, they suggest to educators that attending computer courses is only one very small part in the long-term process of implementing computer technology into classroom practice. As well, they imply that teachers need to be freed from the overwhelming pressure to become computer-literate. As a dynamic educational tool, computer technology will require teachers to reflect constantly upon their teaching. If educators can focus more on teaching methods and practices as the means to successful integration, the hype of computer literacy can be downplayed somewhat and a broader vision of the use of computers in the classroom might be actualized. A focus on teaching seems to be more appropriate than a focus on the technology itself.

This study shows there is not a strong correlation between CSE and classroom practice and further suggests there is little to be gained, in a professional development sense, from focusing primarily on computer literacy. For teachers to be successful in integrating computer technology into their classrooms they need to accept the challenge that the role of the teacher is changing; develop the skills needed to use emerging technologies; and gain some professional certainty as to the reasons why they are doing it.

Professional development for teachers cannot be provided in technologies that do not yet exist. Because technology is changing so rapidly, professional development should probably focus on those skills which would allow teachers to effectively evaluate, select and integrate emerging technologies into classroom practice. Seventy-three of the teachers surveyed in this study had attended at least one computer training course, but the results from Tables 4.3 and 4.4 show clearly that teachers are not using a large variety of strategies to integrate computers into classroom practice. While there were 11 teachers who filled in responses to the 'other uses' section on the survey, 7 of the 11 'other' uses identified were for drill and practice exercises. In short, computer training courses did not seem to have an impact on the variety of computer uses teachers incorporated into classroom practice. Moreover, the information in Tables 4.3 and 4.4, shows that 12 /14 (86%) of the teachers who *had not* attended a computer training course, use computers in their classroom practice on the average of 2.33 uses, yet, 57/73 (78%) of the teachers who *had* attended a computer training course use the computer in the classroom on an average of 2.30 uses. This demonstrates, for this particular group of teachers, the lack of impact the computer training had on classroom practice. In fact, those teachers who did attend a computer training course had a slightly lower average of classroom use than those teachers who did not attend a computer training course.

Implications for Teacher Education Programs.

The most useful finding of this study for teacher education programs is that computer literate teachers do not necessarily teach with computers. This suggests, in part, that teacher education programs should try to create an environment wherein pre-service teachers are asked to explore software applications, and to develop the skills that would allow them to integrate those applications into appropriate curriculum areas. Such an integration might be made more meaningful if pre-service teachers were also given the opportunity to explore a variety of ways to integrate computer technology into their field experiences. Moreover, it is important that teachers be given the opportunity to understand technology and its impact on education. Such an opportunity could best be provided in a course that dealt with the history and philosophy of technology in education.

This study has implications for teacher education programs at least in the following four areas:

1. Computer Related Courses.
2. Computer Methods Courses.
3. Demonstrated Instruction.
4. History and Philosophy of Technology in Education.

1. Computer Related Courses. It is important to raise, once again, the distinction between classroom and instructional use. As this research demonstrates, while the correlation between CSE and classroom use is considered to be weak to moderate, the correlation between CSE and instructional use is considered to be moderate to strong. In other words, those pre-service teachers who have computer skills are more likely to use the computer as an instructional tool. There is enough of a correlation between CSE scores and instructional use for a teacher education program to justify teaching pre-service teachers

how to use specific technologies. It needs to be understood, however, that such courses will benefit instructional rather than classroom practices.

There are at least two ways in which teacher education programs could set up computer related courses. They could be taught to all students through another department such as computer services, or management, or they could be taught through the education department. One problem with offering the courses through another department is that applications to teaching might easily be lost. If taught within the education department, the courses could focus on computer-related skills as they apply to teaching. Moreover, the pre-service teachers would learn by example, how to teach computer courses. Courses offered within an education department could be divided into several areas such as:

a. *Document Processing.* Using word processing to develop tests, outlines, professional plans, unit and lesson plans.

b. *Student Evaluation.* Using databases, spreadsheets and specific marks programs as a way of maintaining student records.

c. *Communication Technology.* Using the Internet to access teaching materials, working with e-mail for communicating with other educators and subscribing to listservs.

The above courses would probably be highly technically-based with a clear focus on teaching.

2. Computer Methods Courses. Courses which focussed on methods of teaching with computer technology would be essential to any teacher education program that wanted to prepare its graduates to teach with technology. Such courses should develop skills associated with selecting, integrating and evaluating computer software applications as they relate to various curriculum areas.

One of the foci of this paper was to develop an appreciation for the need to have effective pedagogic practices as a focus in teacher education programs. Providing pre-service teachers with methods in computer integration would be consistent with the type of courses that are offered for any other discipline area (for example, Math methods, Social Studies methods or Physical Education methods).

3. Demonstrated Instruction. Balli, Wright and Foster (1997) report that many pre-service teachers hold mental images of early classroom experiences when they were students which may not be congruent with contemporary practice. Because teaching today involves teaching with technology, it may be imperative that pre-service teachers engaging in field experience not only be provided with opportunities to integrate technology into their teaching practice; but, that they be instructed in a manner that demonstrates the appropriate integration of technology into classroom practices. In short, if pre-service teachers learn to teach by observing the way in which they are taught, those involved in teacher training and teacher development must take some responsibility for using methods of instruction that effectively demonstrate desired practices.

4. History and Philosophy of Technology in Education. A course which was designed to teach pre-service teachers about the history and philosophy of technology in education, I believe, would enable them to act with a better understanding of technology. Such a course would give them a foundation for making decisions about technology integration into classroom practice. As described earlier in this work, teachers need to develop a position on any new school reform as it applies to their teaching area. Without a solid foundation in the history and philosophy of technology it would be unrealistic to expect teachers to make personal decisions about something of which they know so little. We cannot expect young teachers to develop a stance on technology without giving them the relevant historical and philosophical views of this particular school reform. Therefore,

in addition to providing pre-service teachers with a collection of computer-related skill, those teacher education programs which encourage their student to understand the history and philosophy of technology, are better enabling their students to act as moral change agents in this particular school reform.

At this point, a brief review of the implications in the three general areas might be useful. First, teachers' skill in using a particular technology is not sufficient to enable them to teach with the technology. This implies the need to provide classroom teachers with opportunities to develop teaching techniques for computer integration. This has a direct and obvious connection to professional development. Secondly, within a constantly changing technological environment, teachers will need to constantly review their teaching practices and use professional development to explore possibilities for improving their teaching with new technologies. Professional development, in this way, would focus on teaching methods not on computer related skills. Thirdly, teacher education programs must provide pre-service teachers with computer related courses, methods-related courses, demonstrated instruction, and a course on the history and philosophy of technology in education, as they impact pre-service teachers' use of computers for both instructional and classroom uses.

CHAPTER VI

FUTURE CONSIDERATIONS

While conducting this research. I became more aware of several aspects of technology that I did not get to address directly. Issues kept presenting themselves as I worked through the analysis of the research data and the subsequent discussion chapter. This section of the thesis represents my attempt to organize several issues, my understanding of which has been refined by my experiences with this research study.

Developing a Philosophy of Technology in Education

The first of these issues relates to the idea that educators need to develop a philosophy of technology so that they are better able to discuss its appropriateness in education.

> In our technicalized, present-centered information environment, it is not easy to locate a rationale for education, let alone impart one convincingly. It is obvious, for example, that the schools cannot restore religion to the centre of the life of learning. With the exception of a few people, perhaps, no one would take seriously the idea that learning is for the greater glory of God. It is equally obvious that the knowledge explosion has blown apart the feasibility of such limited but coordinated curriculums as, for example, a Great Books program. Some people would have us stress love of country as a unifying principal in education. Experience has shown, however, that this invariably translates into love of government, and in practice becomes indistinguishable from what still is at the centre of Soviet or Chinese education. (Postman, 1997, p 186)

I believe Postman is accurate in identifying valid criticisms of three traditional approaches to education--The Great Books approach, the Socialist philosophy and the Christian

Schools philosophy. None of these philosophies fits into the Alberta Government's 'results, results, results' approach to education. Educational leaders in Alberta justify the integration of technology studies into the curriculum by claiming they will provide students with the basics needed to participate in an information society.

Using education (schooling) as the means of providing qualified workers for an ever-increasing technological workplace has been in practice for nearly as long as mass schooling has existed. For example, Gomersall (1988), in her discussion of the differentiation of education between working-class girls and boys, illustrates how, as early as 1800-1870, schooling was used to prepare girls to be competent needle workers. Curriculum guidelines specified as much as 50 percent of girls' schooling should be spent learning and developing needle working skills. In this way, not only did the technology of the time (the needle) create specific jobs, it dictated part of the curriculum in basic schools so that schools perpetuated the direction and integration of technology into the lives of the members of society. Schooling was the mechanism for developing a skilled labor force from which technology was able to spread into the lives of all social classes.

There is little argument that the development of mass schooling was perpetuated in order to train skilled workers for the Industrial Revolution. Through schooling, students were exposed to the importance of being punctual, dependable and hard working. Finally, the technology of the time dictated what knowledge was for students in schools: knowledge was the acquisition of technical skills needed to obtain employment.

Career and Technology Studies is a more recent example of technology in the curriculum; incorporated into education, I believe, for two main reasons: 1) to provide two different avenues of schooling--the academic and the vocational; and 2) to ensure that upon high school graduation students were employable. Writers like Adler (1982), and Hutchins (1968), who argue in favor of a liberal arts education, would strongly disagree with both of the curriculums mentioned above. Both approaches dictate, for the most part, what place the student takes in society. Public schooling, during both of the periods identified in the preceding examples, was being used primarily as the vehicle for providing society with technically skilled workers. Whether the technology was a needle or a computer, students were trained at school so that they could fill the demand for labor in the business sector.

Today, with the surge of technology implementation throughout Alberta schools, principals and school boards are hurrying to develop technology plans that encompass a large portion of the existing curriculum. The purpose for the implementation is not always so obviously stated as in the 1800's. Today we are told that the integration of technology is to improve *teaching* and *learning* and to prepare students for an *information* society.

Should schooling be the means by which individuals are helped to exist in an information society? Personally, I see many problems with this approach. First and foremost is the issue of choice. I do not feel that we can continue to use schooling to facilitate economic pursuits, nor can we continue to consume materials to create a society that is constantly moving acceptingly towards new technologies. While the rationale for teaching with technology may have been appropriate in the 1800's (the needle) or the early 1990's (with the computer), I think we have a responsibility to look closely at what technology will mean to us in the 21st century when the possibilities of technology are almost endless. Educators are challenged to make decisions about the integration of technology in schools based on an attentiveness to both educational theory and practice.

Ironically, even back in the 1800's the reality of the situation was that male teachers did not teach needle work and, often, female teachers who were not skilful did not teach needlework as much as they were supposed to either. This seems to confirm the durability of the assumption that a teacher has to be able in a technology in order to teach it. However, I contend that the assumption itself leads today's policy makers into flawed decisions and I feel teaching with and about technology needs to be done from many perspectives.

Several authors argue that for computer technology to become an effective learning or teaching tool, changes must be made to traditional teaching and learning. (See for example, McKenna on Kearsley, 1996; Chisholm, 1995; Forcheri and Molfino, 1994; Cradler, 1994) Teachers simply cannot keep up with the emerging technology of the 21st century. No longer can teachers be thought of as being in possession of all necessary knowledge. Rather technology education should be viewed as a process of enabling, not telling. Moreover, because teachers cannot practically or physically keep apace with technological advancements, it must be through the use of more effective teaching practices that the educational benefits of certain types of software can be made available to students. For example, the Internet can be an excellent resource for doing research on a great number of topics. Practising teachers can use web pages that have appropriate links for a specific subject. These teachers do not need to know how to create a web page. Simply gathering links (sites, web pages, URL's) to add to their webpage, thereby offering to their students a collection of resources for a specific topic is sufficient. In this example, what do these teachers need to know? They need to know that a web page can be created and that a firsthand experience of the Internet is necessary in order to firmly grasp its implications for the classroom. However, such things as the use of web authoring software and publishing electronically do not have to be in their repertoire of skills. The ability to see what resources may be useful to their students, to have a vision of how to group the resources effectively and choose when to integrate these into their classroom teaching are skills that are more useful than being able to develop a web page without those other skills being present.

The Problem with a Technical Focus

Betrayed in the mazes of your ingenuities, sold by the proceeds of your proper inventions. (T. S. Elliot, *Chorus From The Rock, III,* Collected Poems, 1909-1962, p. 169)

A technical focus may have something within it that is unappealing to some groups of teachers. While computer technology can certainly offer some advantages for students, is it reasonable to expect that K-12 schools in Alberta should be the primary avenue for providing students with all requisite skills? Basic practical concerns arise when schools try to integrate the use of computers in all areas of the curriculum. The most obvious concern, of course, is computer maintenance and upgrading. The more schools use computers, the more they need technical expertise and an assured funding supply. As well, if schools focus too much on the development of technical skills, they risk training their students only for specific jobs. They may not then give students transferable skills such as critical thinking skills, creative thinking skills or problem solving skills. In an ever-changing technological environment, it may be an act of futility for schools to train students in such narrow ways because the technology will almost certainly change by the time students enter the workplace.

The development of new technologies, influencing many aspects of modern life, continues at an ever-accelerating pace. Given the speed at which new technologies are becoming available the issue of *knowledge of* these new technologies becomes increasingly a concern in education. In this sense, technology is about emerging information. It is not about the history of technology or attitudes towards that technology but, rather, who *knows* or who *has used* what technology. Here develops one of the problems of a technological focus--technology is more and more about the acquisition of current technical information and a corresponding devaluing of historical knowledge. In one way, knowledge becomes secondary to information.

Roszak (1997) disclaims this view of knowledge by addressing the debate between empiricists and rationalists. He says that, "In our time, minds loyal to the empiricist love of fact have seized upon the computer as a model of the mind at work storing up data, shuffling them about, producing knowledge, and potentially doing it better than its human original..." (p. 103) and later in arguing against the empiricists' view,

> The mind, unlike any computer anyone has even imagined building, is gifted with the power of irrepressible self-transcendence. It is the greatest of all escape artists, constantly eluding its own efforts as self-comprehension. It can form ideas about its own ideas, including its ideas about itself....(yet) the computers can only be one more idea in the imagination of its creator. (Roszak, p. 104)

I think that Roszak is successful in showing that knowledge is not simply information; but, while Roszak is well versed in technology and able to make judgments about it, most teachers in Alberta today are not.

The acquisition of current technical knowledge can be seen as a rather straight-forward practical and intelligent activity. One becomes literate in the emerging technologies so that one is able to participate *successfully* in industry. This is comparable to the view of those modernists who want to liberate students by teaching them technical skills so that they can participate freely as responsible citizens, in a particular technology-dominated world.

Our understanding of what knowledge is, is changing. Regardless of how much an individual reads and how much information an individual can get access to, that person must have the skills to reflect critically on that information in order to transform it into knowledge. An education system that focuses on the integration of technology without a consistent focus on understanding and reflecting on that technology is, in my mind, providing a disservice to its students.

Historically, for some, knowledge was seen as a product of sustained rational and intelligent inquiry. Today, for many, it seems that knowledge is the acquisition of information (and misinformation) that is downloaded from a computer. People are knowledgeable if they can pull it off the screen, not necessarily if they can analyze what they pull off the screen. This process suggests that knowledge can be acquired without appropriating the knowledge as one's own. ("I got it off the Internet", or "I downloaded this last night," are comments that are heard often and clearly hold a certain amount of credibility!) We live in an age in which information flows in an almost boundary-less environment, one in which people seem to care more for the acquisition of and access to information than the need to have the skills to reflect on and critique the information to which they are exposed. I contend, unless individuals appropriate information as their own, it remains information. Only when information becomes self-appropriated can individuals fairly claim 'to know' or to have that knowledge as their own.

Within the world of technology there exists the subtle implication that one should never be satisfied; that there is always more--more to learn, to buy and conquer. As Pacey (1989) suggests, "there is among some people a feeling of compulsion about the pursuit of advanced technologies--a sense that man must be continually proving his virility by pioneering on the frontiers of what is only just possible" (p. 304). Man/woman is always incomplete, never satisfied because he/she is not yet who he can be. These pioneers, then, create a culture of individuals who thrive on the quest for new technological developments. In one sense, technology becomes the culture and the culture becomes technological.

The primary principle behind the implementation of computer technologies in schools is that we must prepare students for an information society. Yet, who determines what this information society is? Why are we in an information society? Who or what has brought us here? Have we simply been coaxed into one by the marketing techniques of big business? Does business create the need for people to feel like *informed citizens,* then claim to help people fill this need by selling the computers, software and services all designed to meet the demand? Further, have we been deceived into thinking that education must be the institution above all others that provides students with the greatest access to every technological innovation? Perhaps it should, but educators should at least know for what reasons and in what way.

Another problem with a technical focus is that it promotes the message that teachers can be replaced by computers. This notion can lend itself to the development of a cultural definition of what it means 'to teach' and to a devaluing of the profession itself. Our society is being led to believe that computers can teach its children. However, given the diverse ideas of what it means to teach, it may be difficult to know what exactly we want the computers to do. Do we want students who are schooled in the Socratic method, or do we want students who have memorized vast amounts of information from a textbook, or a CD Rom? As long as society is unsure about *what* it is the technology is supposed to achieve, the idea of having computers teach remains one that is not very sound.

An assumption that technology can replace teachers limits the definition of teaching to immediate feedback, logical thinking, and one-to-one instruction. Although this may seem attractive initially because such methods can *dramatically increase student learning,* the actualization of such an educational environment would change more than the amount students learn. This viewpoint fails to accept that education is about more than the acquisition of information, that it is about the acquisition of knowledge, skills and attitudes, including the ability to participate as part of a group and develop understanding and appreciation of others' perspectives and beliefs.

A discussion of the appropriateness of a technical focus could continue forever. In this work, I have struggled to promote the role of pedagogy as central in our present, technically focussed education system. A computer is only as good as its user and, accordingly a computer can only be as useful as the degrees to which its user has been taught to use it.

CHAPTER VII

CONCLUSION

It now seems appropriate to revisit the literature review in light of the research findings. The findings of this thesis show that there is a weak correlation between CSE and classroom practice. By looking back at the discussion in chapters two and four, I hope to summarize my work and offer closure to this project.

To begin, recall how Mann (1995) states that the way a technology is introduced can have major implications for its success. In light of this, technology plans that focus on in-servicing teachers in computer skills might not be the most effective way of getting teachers to integrate the technology into their classroom teaching. In this way, the new technology may not become a success because the introduction of the technology into teaching came from a computer–skill related viewpoint. Rather, one might argue in favor of demonstrating how to use the particular technology in a classroom setting--with a focus on methods of instruction and not computer skills.

Several authors agree that technology alone will not change education. (See for example, Fullan et al., 1992; McKenna, 1995; Galligan, 1995) I agree with this statement but would add that either technology *or* technically-skilled teachers alone will not change education. Technology itself has little value for education without the teacher. Moreover, the existence of computer-skilled teachers alone in an environment seeking to integrate computers into classroom practice is not sufficient.

Rosen & Weil (1990) argue that those key features which limit the use of computers have not been inclusive. To date, there is not any definitive statement explaining why computers are or are not used in classroom practice. In reviewing Tables 4.3 and 4.5, one would have to agree that CSE levels are not alone, reliable indicators of computer use in the classroom.

It is fair to say that teaching *about* and *with* technology are two different tasks. This research project does not attempt to identify those 'other' criteria that may encourage teachers to adopt computers into their classroom teaching. However, this research project does attempt to get the reader to accept that the integration of technology into teaching is a major reform movement.

As a major school reform the integration of technology into teaching, and more specifically into classroom practice is an area which merits the attention of teachers, administrators and educational policy-makers. One year ago, I was advocating the need for teachers to become computer literate. I felt that teachers needed to become efficient computer users so that they could teach with computers. Today, I view the integration of computers into classroom practice from a wider perspective--aperspective that must encourage teachers to be creative pedagogues, liberating them from the pressure of become computer literate in a rapidly changing technical environment.

Schools that feel they can integrate computers into classroom practice by simply helping their teachers become computer literate are negating the results of this research. On the other hand, an approach to technology integration which embraces the teacher as pedagogue; focuses on teaching first and technology second; and appreciates the dynamic structure of the classroom in a changing technological environment, will be far closer to actualizing the success of this reform movement.

References

Adler, M. J. (1982). The same objectives for all. The Paideia Proposal. New York: Macmillan.

Balli, S. J., Wright, M. & D Foster, P. N. (1997). Preservice teachers' field experiences with technology. Educational Technology, 37 (5), 40-45.

Bandura, A. (1989). Human agency in social cognitive theory. American Psychologist, 44 (9), 1175-1184.

Bandura, A. (1982). Self-efficacy mechanism in human agency. American Psychologist, 37, 122-147.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, 84 (2), 191-215.

Cradler, J. (1994). Summary of current research and evaluation findings on technology in education. Berkeley, CA, Far West Laboratory. [Online]. Available at: http://www.fwl.org/techpolicy/refind.html (1997, March).

Drury, C. J. (1995). Implementing change in education: The integration of information technology into Irish post-primary schools. Unpublished Master's Thesis, University of Leicester, England.

Eachus, P. (1997). The development of the computer self-efficacy scale. [Online]. Available at: http://xanadu.bournemouth.ac.uk/CD/Eachus/Eachus.HTM (1997, July 28).

Fullan, M. & Miles, M. (1992). Getting reform right: What works and what doesn't. Phi Delta Kappan, 73 (10), 745-747.

Fullan, M. (1992). Visions that blind. Educational Leadership, 49 (5), 19-22.

Fullan, M. (1993). Why teachers must become change agents. Educational Leadership, 50 (6), 12-17

Faseyitan, S. O. & Hirschbulh, J. (1992). Computers in university instruction: What are the significant variables that influence adoption? Interactive Learning International. 185-194.

Galligan, J. (1995). Computers and pedagogy. Paper presented at Australian Computers in Education Conference, 1995. Perth, Western Australia. [Online]. Available at: http://www.oltc.edu.au/cp/refs/galligan.html (1997, September)

Gomersall, M. (1988). Ideals and realities: The education of working-class girls, 1800-1870. History of Education, 17 (1), 37-55.

Harrison, A. W. & Rainer, R. K. (1992). An examination of the factor structures and concurrent validities for the computer attitude scale, the computer anxiety rating scale, and the computer self-efficacy scale. Educational and Psychological Measurement, 52 735-745.

Hirschbuhl, J. J. & Faseyitan, S. O. (1994). Faculty uses of computers, facts and perceptions. T. H. E. Journal, Feature 4/94.

Hutchins, R. M., (1968). Liberal education for all. The learning society. New York: Praeger.

Hughes S. & Shapiro J. (1996). Information literacy as a liberal art: Enlightenment proposals for a new curriculum. Educom Review, 31 (2).

Kingwell, M. (1996). Dreams of millennum: Report from a culture on the brink. Toronto, Canada: Penguin Books Ltd.

Koslowsky, M., Lazar, A. & Hoffman, M. (1988). Validating an attitude toward computer scale. Educational and Psychological Measurement, 48, 517-521.

Kowalski, L. (n. d.) An exploration into teaching with computers. Unplublished paper presented to teachers

Kraus, S. & Kraus L. (1995). Faculty images of technology integration in teacher education. [Online]. Available at: http://www.coe.uh.edu/insite/elec_pub/html1995/189.htm (March, 1997).

Maitland, C. (1997). Measurement of computer/internet self-efficacy: A preliminary analysis of computer self-efficacy and internet self-efficacy measurement instruments. [Online]. Available at: http://www.tc.msu.edu/TC960/CSE.HTM (February, 1997).

Mann, B. (1997). Approaching change. [Online]. Available at: Http://calvin.stemnet.nf.ca/Community/Prospects/v1n3/apprchan.htm (September, 1997).

Mason, R. D. & Lind, D. A. (1993). Statistical techniques in business and economics. Boston, MA: Irwin Publishing.

McKenna, S. (1996). Attitudes of a sample of CSU staff to changing technologies. Open Learning Institute. [Online]. Available at: http://www.csu.edu.au/d...d/occpap17/attitde.htm (September, 1997).

Meyers, M. D. Section Editor. (1997). Qualitative research in information systems. ISWORLD_NET. Available on-line at: http://comu2.auckland.ac.nz/~isworld/quality.htm

Miller, L. & Olsen, J. (1995). In Canada: How computers live in schools. Educational Leadership, 53 (2), 74-77.

Miura, I. T. (1987). The relationship of computer self-efficacy expectations to computer interest and course enrollment in college. Sex Roles, 16 (5/6), 303-309

Murphy, C. A., Coover, D. & Owen, S. (1989). Development and validation of the computer self-efficacy scale. Educational and Psychological Measurement, 49, 893-899.

Neuman, W. L. (1997). Social research methods: Qualitative and quantitative approaches. Needham Heights, MA: Allyn & Bacon.

Pacey, A. (1989). The maxe of ingenuity: Ideas and idealism in the development of technology. Cambridge: The MIT Press.

Patton, M. Q. (1990). Qualitative evaluation and research methods. 2nd Edition. Newbury Park, CA: Sage Publications.

Popovich, P. M., Hyde, K. R., Zakrajsek, T. & Blumer, C. (1987). The development of the attitudes toward computer usage scale. Educational and Psychological Measurement, 47, 261-269.

Roszak, T. (1986). The cult of information. Toronto, Canada: Random House.

Wetzel, K. & Chisholm, I. (1995). An evaluation of technology integration in methods courses. Arizona State University West. [Online]. (February, 1997).

APPENDIX A--The Survey

Computer Self-Efficacy Scale

The purpose of this questionnaire is to examine the benefits and difficulties people experience when using computers. The questionnaire is divided into three parts. In Part 1 you are asked to provide some basic background information about yourself and your experience with computers. Part 2 aims to elicit more detailed information by asking you to indicate the extent to which you agree or disagree with a number of statements provided. Part 3 is used to identify how you are currently integrating technology into your teaching.

Part 1

Experience with computers (please place a tick by the appropriate response)

- ☐ none
- ☐ very limited
- ☐ some experience
- ☐ quite a lot
- ☐ extensive

Please indicate (tick) the computer packages (software) you have used

- ☐ Word processing packages
- ☐ Spreadsheets
- ☐ Databases
- ☐ Presentation packages (eg. Power Point)
- ☐ Statistics packages
- ☐ Desktop publishing
- ☐ Multimedia
- ☐ Other (specify)

Do you own a computer?

- ☐ yes
- ☐ no

Do you have access to a computer when you are not in school or at work?

- ☐ yes
- ☐ no

Have you ever attended a computer training course?

- ☐ yes
- ☐ no

Part 2

Next you will find a number of statements concerning how you might feel about computers. Please indicate the strength of your agreement/disagreement with the statements using the six point scale shown below where 1=strong disagreement and 6= strong agreement with a particular statement.

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

You can indicate how you feel by choosing a number between 1 and 6. Click on the button which most closely represents how much you agree or disagree with the statement. There are no 'correct' responses, it is your own views that are important. It will take you only a few minutes to complete the twenty-nine statements that make up the questionnaire, but it is important that you respond to each statement. Please select the most appropriate choice for you.

Q1. *Most difficulties I encounter when using computers, I can usually deal with.*

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q2. *I find working with computers very easy.*

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q3. *I am very unsure of my abilities to use computers.*

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q4. *I seem to have difficulties with most of the packages I have tried to use.*

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q5. *Computers frighten me.*

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q6. *I enjoy working with computers.*

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q7. *I find computers get in the way of learning.*

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q8. *Computers make me much more productive.*

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q9. *I often have difficulties when trying to learn how to use a new computer package.*

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q10. *Most of the computer packages I have had experience with, have been easy to use.*

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q11. *I am very confident in my abilities to use computers.*

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q12. *I find it difficult to get computers to do what I want them to*

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q13. *At times I find working with computers very confusing.*

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q14. *I would rather that we did not have to learn how to use computers.*

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q15. *I usually find it easy to learn how to use a new software package.*

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q16. *I seem to waste a lot of time struggling with computers.*

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q17. *Using computers makes learning more interesting.*

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q18. ***I always seem to have problems when trying to use computers.***

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q19. ***Some computer packages definitely make learning easier.***

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q20. ***Computer jargon baffles me.***

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q21. ***Computers are far too complicated for me.***

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q22. ***Using computers is something I rarely enjoy.***

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q23. ***Computers are good aids to learning.***

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q24. ***Sometimes, when I am using a computer, things seem to happen and I don't know why.***

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q25. ***As far as computers go, I don't consider myself to be very competent.***

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q26. ***Computers help me to save a lot of time.***

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q27. ***I find working with computers very frustrating.***

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q28. ***I consider myself a skilled computer user.***

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Q29. ***When using computers I worry that I might press the wrong button and damage it.***

Strongly Disagree 1 2 3 4 5 6 Strongly Agree

Part 3

Technology Integration Questions:

Please check all the appropriate boxes.

A. 1. ***I have access to computers at school?***

- ☐ yes
- ☐ no

2. ***There are computers available for my students during my classes?***

- ☐ yes
- ☐ no

if no, go to 'B', if yes answer next question:

3. ***The computers available to my students during my classes are:***

- ☐ in my classroom
- ☐ in another room.

B. ***I teach the following grades:***

- ☐ k-3
- ☐ 4-6
- ☐ 7-9
- ☐ 10-12

C. ***I use computers for the following instructional purposes:***
For each item selected please identify a grade level in the space provided on the right. For example, if you use a marks program for keeping track of the grades in your grade 10 class; place a check or an 'X' next to student marks and place the number 10 in the column below 'List Grade Level Here'.

Check Here		List Grade Level(s) Here
X	student marks	10
____	student marks	____
____	course outlines	____
____	test development	____
____	yearly professional development plans	____
____	Instructional plans (unit or year plans)	____
____	lesson plans	____
____	Student ex.	____
____	telecommunications outside of the classroom	____
____	e-mail for communicating with other educators	____
____	Other: (please specify)	____

____

____

D. ***I require my students to use computers for the following:***

	List Grade Level(s) Here
☐ writing assignments	____
☐ engaging in research	____
☐ solving problems	____
☐ developing presentations	____
☐ completing assignments	____
☐ communicating with other students in school	____
☐ communicating with other students outside of school	____
☐ Other: (please specify)	____

____

____

____

Thank You!

You have now completed the questionnaire thank you for your time and many thanks for helping with my research.

Please return questionnaire to:

Lorraine Beaudin
200 Laval Blvd.W.
Lethbridge, Alberta T1K 4E6
PHONE: (403) 328-8156 (H)
e-mail: beaulc@hg.uleth.ca