# A STUDY OF INFORMATION AND COMMUNICATION TECHNOLOGY INTEGRATION BY FACULTY TEACHING IN A UBIQUITOUS LAPTOP BACHELOR OF EDUCATION PROGRAM

by

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## Abstract

The fast pace of technological change within education has made it challenging for Faculty of Education professors to keep current with the integration of Information and Communication Technology (ICT) into teaching. This study focuses on an Ontario university Faculty of Education's ubiquitous laptop program. Diffusion of innovation theory was used as a conceptual framework to examine how Faculty of Education professors perceive they are learning and integrating ICT into the preservice program despite a lack of formal ICT standards in the education system of Ontario.

In 2007, data were gathered through interviews with faculty, administration, technical assistants and recent B.Ed. graduates. The faculty participated in an online survey to determine what ICT was being used and integrated within the B.Ed. program. In the analyses, data were organized into five themes based on Rogers (2003) diffusion of innovations theory: innovations used by faculty, adoption of innovations, organizational support of the adoption, unexpected consequences of the innovation, and increasing the rate of adoption.

The findings from the faculty survey and interviews indicate that while many professors often integrated technology in their teaching, there existed a wide range of skills, confidence levels, and amount of ICT integrated into teaching among faculty. Issues influencing the adoption of effective technology integration that arose from the study include: lack of faculty development, off task behavior of preservice teachers, lack of time to learn ICT, technical difficulties, technical support concerns, wide range of ICT skills of preservice teachers, and the high cost of the laptops themselves. The lack of provincial ICT standards may have further

contributed to the varied degrees of ICT integration at the university as well as that within schools in the practicum setting.

Recommendations were made that have the potential to improve the effectiveness of ICT integration into the Bachelor of Education program and also provide direction for future faculty development initiatives, including faculty development. Findings from this study may be beneficial to researchers who are studying the faculty experience in ubiquitous laptop Faculty of Educations or other educational institutions considering ICT integration.

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# 1 Chapter 1 Introduction

## 1.1 The purpose of the study and statement of the problem

There has been a growth in the number of laptop schools, colleges and universities worldwide (Brown, 2008). Bachelor of Education (B.Ed.) faculty members instruct preservice teachers how to teach based on their own experiences within the classroom and often model effective pedagogy (Lortie, 1975; Kariuki & Duran; 2001). As laptop schools are a relatively recent phenomena, many faculty do not have experience in teaching and integrating Information and Communication Technology (ICT) in a ubiquitous laptop environment. This thesis explores how Faculty of Education professors in such a computing environment perceive how they are learning to integrate ICT into their teaching using diffusions of innovations theory (Rogers, 1962) as the conceptual framework to better understand the adoption process.

## 1.2 The significance of the study

The overall significance of this study lies in how the results and recommendations have the potential to improve the ICT learning environment of the Faculty of Education professors who teach in a laptop program. This in turn may improve the learning environment of the preservice teachers who may model their professors in teaching students in the classroom. These results also may be helpful for other Faculties of Education that have or are considering ubiquitous computing. This study contributes to the body of research of ubiquitous computing in Faculties of Education as well as diffusion of innovation research.

Two approaches are taken to examine how this study fits into the literature, from a ‘micro’ approach in how it fills a niche or a gap in the literature and from the ‘macro’ approach in how it contributes to education and society. There are valuable previous studies of ICT integration including Penuel (2006) who completed a research synthesis of 30 studies of laptop implementation and the effects of one to one initiatives in schools, and Bethel, Bernard, Abrami, and Wade, (2007) who completed a systematic review of 94 research studies in schools. However, these were school settings which have less applicability to post-secondary contexts. Similarly, Kay (2006) completed a meta-analysis on strategies of integrating technology into preservice education, but the 68 studies analyzed were also not specific to ubiquitous laptop teacher education programs.

There are a number of studies on the implementation of laptop universities, which have been in existence since Drew University started the first laptop educational institution in 1988 (Brown, 2000; Burg & Dominick, 1998; Brown & Pettito, 2003; Lim 1999). If however, there is a Faculty of Education used in the studies, it is not always specifically identified. Studies of ubiquitous computing in Faculties of Education constitute a smaller subset of research and are described in more detail in the literature review.

This current study fits into the body of knowledge of the faculty experience in teaching in a laptop teacher education program. Specifically, it describes how faculty integrate ICT into their teaching in a laptop program without National or provincial educational standards in ICT. The studies completed in Faculties of Education in the United States incorporate the standards adopted by the National Council for Accreditation of Teacher Education (NCATE, 2007) and the International Society for Technology in Education National Education Technology Standards (ISTE NETS, 2004). Their goal is to educate teachers to meet these ICT standards and to have them teach in schools that uphold the same standards. The Faculties of Education in Ontario have no similar formal ICT standards (Weeks, 2003; van Woudenberg, 2005), and have varying degrees of ICT integration. Most Faculties of Education in Ontario offer an eight month consecutive teacher education program, except for OISE/UT which additionally offers a two year Master of Teaching program (leading to an M.Ed. and B.Ed. certification). There are also four and five year B.Ed. concurrent programs offered in a number of Ontario Faculties of Education. Most faculties in the rest of Canada and the United States have a minimum two-year program. The laptop university in this study uses a combination of five strategies including: a stand alone 12 hour technology course, offerings of mini-workshops, the integration of technology into courses, modeling how to use ICT by faculty, and improved access through ubiquitous computing. Kay (2006) in his meta-analysis of ICT integration in B.Ed. programs, identified ten different strategies in ICT integration and found that the presence of four or more strategies resulted in a more pervasive use of computer use by preservice teachers.

Given that many of the Education faculty members in the institution under study have not had the experience of teaching in a laptop environment, this study focuses on how the professors are learning about ICT and how to integrate it into their teaching in a

laptop education program. As faculty turnover is a common occurrence at many universities, this study includes the learning experience of new faculty members who have had to quickly learn about the organizational culture as well as teaching in a ubiquitous laptop program. There are many external and internal factors influencing the process of how professors learn ICT in an educational environment and this study includes data gathered from preservice teachers, technical assistants and administrators as all are interdependent in the education process.

The study examines how the faculty members are integrating technology in a laptop setting, listing the kinds and purpose of ICT used, what ICT is integrated into preservice teacher assignments and various ICT teaching strategies. It also examines the technology skills they had initially and how they have improved, how perceived learning occurs, who they speak to when they learn about ICT, the amount of interactions with colleagues and other people in the community, and the amount of faculty development received.

### 1.3 Research questions

The questions investigated in this study are:

1. What ICT tools and methods are being used by Faculty of Education professors and how do they integrate ICT into their teaching?
2. How do Faculty of Education professors perceive they are learning how to integrate ICT into their teaching? What kinds of faculty development do they receive?
3. How does the professional environment support practices of professors' integration of ICT into preservice teaching at the university?
4. What are the issues that hinder the Faculty of Education professors when integrating ICT into their preservice teaching?
5. What changes to the B.Ed. program would facilitate Faculty of Education professors' integration of ICT into their teaching?

### 1.4 Definitions

**AALF:** Anytime Anywhere Learning Foundation (AALF, 2008)

**CBAM:** Concerns Based Adoption Model originally proposed in 1973 by Hall, Wallace and Dossett and has been extensively used as a model of change within schools (Hall & Hord, 1987).

**CMC:** Computer Mediated Communication

**ICT**: Information and Communication Technology. Information and Communications technologies are a diverse set of technological tools and resources used to communicate, and to create, disseminate, store and manage information (Blurton, 1999). ICT includes the use of computer technology, including hardware, peripheral devices, media, delivery systems and software. This term is used in the ISTE NETS standards and is used by UNESCO in reference to the integration of technology into teaching (UNESCO, 2002).

**ISTE**: International Society for Technology in Education, a non for profit organization supporting the use of ICT integrated into teaching for K-12 students and teachers. It is funded by many companies within the computer industry. This body created the National Education Technology Standards (NETS) and the Essential Conditions for integrating ICT. (During the data collection, this study used the ISTE NETS (2004) which has since been revised to ISTE NETS (2008) at time of writing.)

**NCATE:** National Council for Accreditation of Teacher Education is an organization that accredits teacher education institutions in the United States.

**NETS** National Education Technology Standards is the standards of ICT competencies set by ISTE for students, teachers and administrators in the United States but also adopted by many other countries, including UNESCO.

**Laptop Program**: Any organization that mandates that all participants utilize a laptop computer. This is also called ubiquitous computing and 1:1 computing.

**OCT**: Ontario College of Teachers is the professional body of Ontario educators. This organization accredits Faculties of Education in Ontario.

**OCUP:** The Ontario Curriculum Unit Planner is a software program developed with the support of the Ontario Ministry of Education to assist in the development and use of unit plans.

**OKNL:** Ontario Knowledge Network for Learning.

**OSAPAC:** A software license agreement with the Ontario Ministry of Education through the Ontario Software Acquisition Program Advisory Committee (OSAPAC) with various educational software providers.

**Preservice Teachers:** People enrolled in a teacher education program.

**Students:** Students in this study refer to people who are enrolled in the K-12 educational system. Occasionally B.Ed. professors refer to preservice teachers as B.Ed. students. In this study, 'students' will refer to K-12 students.

**STA**: Student Technical Assistant. These were preservice teachers hired by the university to work in providing ICT support for their colleagues and faculty.

**Technology Literacy**: defined as "Computer skills and the ability to use computers and other technology to improve learning, productivity, and performance." (U.S. Department of Education, 1996).

**Ubiquitous laptop environment**: A working environment where all people have equal access to the same computer technology. In this study, all preservice teachers and faculty at the university had access to a laptop computer with the same software supported by a wireless infrastructure.

**UNESCO:** United Nations Education Science Cultural Organization. A United Nations Organization that has a comprehensive policy on ICT integration into education.

**UTS**: University Technical Services is a department at the university where ICT hardware tools such as laptops are fixed and software is installed. They manage all software licenses.

## 1.5 Background of the Researcher

I graduated in 1985 with a B.Ed. Since then, I have gained practical experience teaching in elementary schools and have taught math, science, biology, chemistry, and physics in secondary schools, and at the college level. In 2000, I completed my M.Ed. and have been teaching science and the chemistry electives in a B.Ed. program since that time.

In 2000, a new Dean started at the university in which I was teaching and suggested that the B.Ed. become a mandatory laptop program. With the unanimous support of the faculty, the laptop program began with one section (class) as a pilot in 2002 and by 2005 all preservice teachers were required to purchase or lease a laptop

computer. In 2001, the same laptops were provided to all faculty members with the unwritten expectation that it would be integrated into their teaching.

Once the laptop was introduced, my role became two-fold; teaching teachers how to teach science, as well as how to teach using a computer. Given the rate of change in technology has happened quickly, most professors within the Faculty of Education, would not have had the opportunity to gain enough experience teaching with the laptop in a regular classroom. Thus, one significant challenge that needs addressing with such a group is the lack of experience of integrating technology into their teaching.

When I started teaching at the university, I was one of the younger faculty members, and many professors were in the same predicament as I was, in that we were experienced enough to teach about teaching, but lacked experience in teaching with computers, or ICT in general. Software and hardware change with frequent upgrades, and it does not take long before it becomes out of date. Staying current with the changes in ICT is a continual learning process which requires a significant time and energy commitment.

In teaching at the Faculty of Education, one has to be aware of the ICT teaching practices that are being used effectively in the field, so this knowledge can be shared with preservice teachers. I determine if the ICT is practical, worthwhile, and affordable and how it is being taught in the schools. For example, I purchased a pH meter that linked into a laptop computer that measured pH as well as plotted the change over time on a graph. This was a great tool, however, the high cost of this item accompanied with the laptop, made it an unlikely purchase for the average Ontario high school. From a practical point of view, the preservice teacher may need to know how to teach a lesson with more inexpensive traditional tools that they would likely see in the average classroom, such as litmus paper, indicator solutions and perhaps a pH meter. To teach preservice teachers solely from the laptop perspective would be irresponsible, as it would not adequately prepare them for an authentic classroom experience. Yet, it is still worthwhile to let them experience working with ICT tools to demonstrate the potential benefits, as students in the future may require these skills in a business or industrial setting. Finding the balance between old and new technologies and what is most practical for the preservice teacher is often a challenge.

For example, when I am teaching science, I can relate back to past classroom experiences with some degree of confidence knowing a lesson will work, as I have often previously taught a particular topic in a real classroom situation. However, I often feel a lack of experience and confidence about whether various kinds of ICT are practical for a particular classroom use. Many lessons with ICT should theoretically be effective in the classroom but I have to rely on listening to the experiences of the preservice teachers or practitioners in the classroom to determine if a lesson or teaching strategy will be worthwhile to use. Unfortunately, many of the schools do not have an effective ICT infrastructure, making any kind of sustained ICT use impractical. However, there are some schools that do support teaching with ICT, enabling those teachers to provide a potentially richer teaching experience for the students.

Teaching science provides plenty of opportunities for integrating ICT. There are various types of software, simulations, and additional hardware that make it possible to easily integrate the computer within the classroom. The Internet provides a huge resource for teaching strategies, ideas and lesson plans. The Ontario Ministry of Education licenses software that can be used in the classroom. Each different subject area has unique opportunities for ICT. It is the responsibility of the professor and the teacher to keep current in their professional teaching and with the technology.

My own proficiency on the computer has improved tremendously in the last 14 years. I did not have the opportunity to learn how to type in high school. It was not until I started writing my M.Ed. thesis in 1999 that I decided to learn this skill. Up until about five years ago, it was faster for me to write by hand rather than keyboard. The university provides a small ‘typing pool’ department, Faculty and Administrative Services (FASS) who are skilled at word processing and are hired to work for professors and administrators who have not mastered the skill of typing. I have brought in a few hand-written items for them to type in the past, but I am now adept enough at keyboarding to complete things on my own. I have found that writing with a word processor required learning a different skill set than writing by hand. The more I use a laptop the more proficient I have become, and I can now recognize the potential it has as an effective teaching tool.

I do admit to a bias towards valuing the use of the laptop, a positive view that may have impacted the writing of this thesis. Since I have taught at this university, I have made an active attempt to integrate ICT into my teaching, I have looked for solutions for the ICT problems that have arisen and when possible have attempted to learn more about ICT integration. I assumed many faculty members would have had similar beliefs and values in regard to ICT integration.

I have countered my positive bias by including within the literature review a balanced view of the research, including studies by researchers that were both favourable and unfavourable toward technology. Recognizing this bias, I have attempted to keep a balanced view in the reporting of the data by including many examples of comments from faculty and preservice teachers with both the negative and positive effects of the use of ICT in teaching. However, the question at issue was not one of choice of whether or not to use laptops in teaching at the university. That choice was already determined, the laptops having been mandatory since 2002 and this practice will probably continue. My motivating question was how can I learn to effectively improve the integration of ICT in teaching and model these practices for preservice teachers? The answer to this question extends into how I can share what I have learned from this study to others who teach using ICT in Faculties of Education.

## 1.6 Conceptual Framework

Diffusion of innovations theory was used as the conceptual framework to better understand how professors integrate ICT into their teaching. Diffusion of innovations theory is the study of how innovations are diffused and adopted into social systems (Rogers, 1962). Historically, the concept of diffusion research dates back to the turn of the century with work by Tarde, and existed among various disciplines but was united with Rogers' seminal book Diffusion of Innovations (Rogers, 1962). He reviewed 506 diffusion studies and found that there were related patterns of the adoption process in this body of research. Diffusion research now includes a large body of literature including: agriculture, health, anthropology, sociology, industry, medicine, and education. The most recent edition of Diffusion of Innovations (2003) indicated that there are now over 5,200 studies and growing. One of the reasons there was so much interest in diffusion of innovations research was because of the difficulty that people and organizations have had

in getting a new idea adopted, even when it has obvious advantages. Many innovations endure a long period of time from when they are available to when they are fully adopted (Rogers, 1962). The use of diffusion of innovation theory to examine ICT integration by faculty teaching in a ubiquitous laptop Bachelor of Education program should prove useful to identify factors involved in the adoption process.

Diffusion of innovations theory (Rogers, 1962) has been used as a conceptual framework in related studies regarding the adoption of ICT. The adoption of the computer into many organizational contexts has been studied utilizing the conceptual framework of diffusion of innovations (Huff, 1987; as cited in Dooley, 1999). Early research in diffusion in education found that there was a considerable time lag in the adoption of new educational ideas (Rogers, 1983). Dooley (1999) used diffusion of innovations theory in a study on how teachers were adopting technology in Texas schools. This holistic approach examined the uncertainties of the benefits of technology as well as the changes that occur with the adoption of the technology including demand for technical support, pedagogical/instructional management issues and teacher professional development. Ellis (2004) used diffusion of innovation theory in his study with action research to encourage School of Education faculty at a mid western United States college to model ICT integration into their teaching. The literature search indicated that there has been little previous use of diffusion theory to evaluate the ICT integration within studies of ubiquitous laptop Faculties of Education.

Within this thesis, diffusion of innovations has been used as the conceptual framework and will be used to aid analysis and discussion to gain a better understanding of the factors involved as Faculty of Education professors learn how to integrate ICT into their teaching within a ubiquitous laptop program. An overview of diffusion theory is described within the literature review. In this study, the Faculty of Education adopted the laptop as an educational tool starting in 2002 for both faculty and preservice teachers. The laptop itself is considered a tool, however it contains many different software applications, each of which could be considered a separate piece of technology that may or may not be adopted by faculty. Even though the university as an organization has adopted the laptop, each individual professor must undergo a decision making process to adopt or reject the use of the technology within their teaching. Rogers (2003) terms a

bundle of related innovations as a technology cluster. The laptop would thus be considered a technology cluster from this perspective. It is an innovation that also contains many applications that could also be considered as distinguishable innovations, including availability to the Internet, which increases accessibility to an unlimited number of technological resources.

## 1.7 Outline of the Thesis

Chapter One describes the purpose and significance of the study; lists the research questions, the definitions of key terms, and describes the background of the researcher.

Chapter Two reviews the literature addressing the question of efficacy of laptop programs, examines previous studies of ubiquitous laptop Faculty of Education programs, the effectiveness of faculty development in ICT integration and presents an overview of diffusion of innovation theory (Rogers, 2003).

Chapter Three describes the methodology, the participants, the methods of data collection, the data sources and how the data were analyzed.

Chapter Four describes the analysis of the data and is divided into five main themes: technology tools and integration used by faculty, professional development, supporting the integration of ICT into teaching, issues of integration of ICT into teaching and the increase of ICT into teaching.

Chapter Five includes a discussion of the five research questions accompanied with recommendations on how to improve ICT integration. The practical and theoretical implications are discussed followed by the limitations of the study and areas for further research.

# 2 Chapter 2 Literature Review

## 2.1 Introduction

> Teaching and learning with laptop computers will never be completely accepted in the higher education community until considerable evidence of the efficacy of laptop computers in this setting is provided. (Bin-Taleb, 2005, p. 184)

While computer use has increased in all parts of society, this literature review examines why there is still some discussion as to the nature of the value of the one-to-one laptop computer in educational programs. The areas of discussion involve; the history of the technology cycle in schools, the expectations that ICT had for improving education, technopositivism, and the effects of ICT on student achievement. This study examined the historical cultural introduction of previous communication tools into society such as language, writing and electronic media as factors in assessing the efficacy of ubiquitous computing in an educational context. The strengths and weaknesses of previous research using computers in schools were examined. This led to a reconsideration of the definition of technological literacy and learning the skills needed to develop computer proficiency including frequency of use.

An examination of studies of the existing Faculties of Education supporting ubiquitous computing environments can provide direction for other educational institutions engaged in similar enterprises. Establishing effective teacher education programs are important as they have an impact on the skills, attitudes and practices long into the professional educators' careers (Lortie, 1975). The studies of laptop teacher education programs can be categorized into three main areas; the implementation process of ubiquitous computing; the experiences of the preservice teacher, and the experiences of the faculty.

The quick pace of technology in education has created concern for educators who desire to keep current and leads to the question of how they are learning ICT and its integration into teaching. One means by which professors learn is through faculty development and this literature review examines studies that recognize its effectiveness in teacher education.

Diffusion of innovation theory has been used in various education research contexts (Rogers, 2003) including technology integration as a conceptual framework

(Shea, Pickett & Li, 2005). While diffusion of innovation theory has been used within technology and teacher education (Willis, Thompson, & Sadera, 1999), it has not been widely cited within the literature of ubiquitous computing in Faculties of Education except for Rader (2005).

The review of the literature takes its areas of focus from Bin-Taleb's (2005) framework of laptop computer use through examining studies in three connected areas; 1) efficacy of laptop programs in education; 2) results of studies of laptop programs in Faculties of Education; and, 3) faculty development in the teaching of ICT. Finally the literature review will present an overview of diffusion of innovation research and its use in education.

## 2.2 Efficacy of laptop programs in education

### 2.2.1 The pace of ICT in education

Overall laptop sales worldwide are increasing and may overtake desktop computers in the near future (Brown & Green, 2008). Much of this market has been fuelled by educational institutions requiring students to purchase laptops (Hruska, 2008). The use of ICT has been increasing in education and will likely continue and, as technology becomes more affordable, laptops in a wireless environment are becoming established as the tool of choice.

Many schools are adopting ubiquitous computing, where every child at a certain grade has a laptop. For example, the Anytime Anywhere Learning Foundation (AALF) has a self-reporting database of, one to one laptop schools from around the world. As of June 2008, there were 89 registered schools from Canada, United States, Australia, and India (AALF, 2008). Other countries, including Uruguay, Argentina, Brazil and Libya will also be providing a laptop for every school age child through the One Laptop Per Child program (OLPC, 2008). The state of Maine is providing a laptop for every child in grade 7 (Papert, 2001). At present, there are many school boards or districts providing laptops for students.

Papert (1987), a supporter of the LOGO computer language for children, predicted that the computer would change education. He comments on the state of Maine providing laptops to all students and how this trend will continue:

> The idea of giving every student a laptop was not invented in Maine. Many more individual schools have adopted this policy elsewhere than there are schools in Maine. But Maine is the first to adopt the "laptop option" on a statewide basis. If we can mobilize the intellectual resources and the patriotic pride of a whole state -- and we are not talking about just any state -- the policy stands to achieve hugely better results than it has elsewhere. If so it will be emulated and once more confirm the old maxim. As goes Maine, so goes the nation. But this time it will be: so goes the world. (Papert, 2001, p. 3)

With this infusion of ICT into education, the increasing number of laptop schools worldwide, the demand for teachers to teach within a laptop school may increase as well. Teacher education institutions may have to prepare teachers to teach integrating ICT into their teaching. Teaching students with laptops establishes a different environment than traditional classrooms and requires the teacher to have ICT knowledge and skills, effective ICT teaching strategies, effective classroom management as well as technical support (Bonifaz & Zucker, 2004).

Despite the increase in computers and the increased numbers of laptop educational institutions, doubts remain in the minds of some teachers and researchers about the educational value of the technology in schools (Cuban, 2001), making it important to scrutinize their concerns. Examination of the patterns of previous innovations that have been introduced into schools in the past may help address and resolve Bin-Taleb's (2005) concerns that educational institutions are reluctant to accept the laptop until its efficacy is proven.

### 2.2.2 History of technology cycle in schools

The computer as an educational tool, arrived in schools with a lot of prior enthusiastic claims about how it could be used to reform education: 1) by making schools more efficient and productive, 2) by transforming teaching and learning into an engaging and active process connected to real life and 3) by preparing the current generation of young people for the future workplace (Cuban, 2001). The computer is but one of many technologies that have been introduced into education. Cuban (1986) describes some of the patterns that have emerged in the adoption of many innovations within educational systems.

Cuban (1986) studied the classroom use of technology since the 1920's including the use of radio, film, instructional television and the early use of computers in the

classroom. He recognized a cycle of technological innovation, continuing to today's case of integrating ICT, that is similar to past innovations in instructional technology that have occurred within the past century such as radio, film, instructional television, and computer assisted instruction. He describes this cycle as starting out with the introduction of the new technology and of claims as to how it will revolutionize teaching practices and improve learning among students. The technology is typically supported by claims of increased learning, efficiency and productivity, and the prediction that the new technology will make extraordinary changes in teacher practice and student learning. The idea that the use of the technology will improve education is also sold to the public during this process. These claims are often promoted by the companies that create the particular technology. As an example, Cuban quotes Thomas Edison in 1922 claiming that film will replace the textbook and that textbooks are 2% efficient while film is 100% efficient. There is no study on how Edison decided what efficiency is, but his statements probably carried some weight in the media with his stature as inventor and businessman (Cuban, 1986).

The next phase of the cycle involves the recognition by the reformers, foundation executives, educational administrators and wholesalers that solutions to educational problems can be fixed with technological advances and their embedding into classroom practice. Typically, academic studies were the next phase, comparing the effectiveness of the new technology with conventional instruction. There would be occasional complaints from teachers or classroom observers about the logistics of use, technical imperfections, the incompatibility with current programs or related reasons as to why the technology had difficulties being implemented (Cuban, 1986), but these would generally be outweighed by the benefits.

Later studies would find the actual use of the instructional technology to be more infrequent than earlier claims suggested. These studies would also reveal that often, new machines were left in rooms unused. The studies would frequently further claim that these problems were the fault of teachers who resisted learning the technology and blocked new developments. There were few scholars, policy makers or teachers who apparently questioned the original claims of the people who were promoting the technology or asked whether the technology should be introduced (Cuban 1986).

> The exhilaration / scientific-credibility / disappointment / teacher bashing cycle described here drew its energy from an unswerving, insistent impulse on the part of nonteachers to change classroom practice. Reformers branded stability in teacher practice as inertia or knee-jerk conservatism. They viewed teacher reluctance as an obstacle to overcome. Seldom did investigators try to adopt a teacher's perspective or appreciate the duality of continuity and change that marked both schools and classrooms. (Cuban, 1986, p.5)

Cuban (2001) identifies a number of reasons why machines are not being utilized regularly in the classroom by teachers, and one important one is the unreliability of machines which can break down and be undependable. Another key problem is often accessibility. If the technology is nearby and easy to access when needed, it will be used more frequently. However in a school setting, ICT often has to be signed out ahead of time, requires additional time and effort to utilize, and consequently may be used less frequently (Cuban, 2001).

Technology may also not be utilized if technology is mandated by administrators. If non-teachers decide that a machine is an effective teaching tool and create a policy to mandate its use, teachers tend to resist and not use the technology (Cuban 2001).

Cuban (1986) discusses the nature of the teaching profession and the position that teachers are largely conservative and reluctant to embrace change. This position is based upon the argument that teachers were students for most of their lives and continue to perpetuate teaching practices that they have experienced as a student. Additionally, there are some teachers who believe that media is entertainment, and excessive use of films or television is less than professional. In this perspective all technology is somewhat tainted as a teaching tool.

However, there have been historical changes in teaching and Cuban (1986) states that teaching practices have evolved over time:

> Remember for example, that whole-group instruction was a nineteenth-century innovation, an efficient way of coping with student diversity. The introduction of worksheets for students to complete in class while the teacher worked with one or more students was a practical solution to a classroom management problem that all teachers faced. The chalkboard and textbook were efficient, flexible technologies providing students with the same information. Some of what were innovations for earlier generations of teachers became conventional and durable practices for later ones. (Cuban, 1986, p. 65)

Cuban (2001) argues that the computer is undergoing the same cycle as any other classroom teaching innovation, and that it is premature to consider the investment in computers in schools a failure because of a lack of research evidence of increased productivity and changes in teaching and learning. Some suggestions that he makes to improve the use of school computing so a fair assessment can be made of its value are: 1) speed up the process of making computers readily available to students in each classroom, 2) eliminate the gap in Internet access between urban and suburban schools, 3) invest more in online curriculum and distance learning, 4) increase on-demand technical support for teachers and 5) add more professional development (Cuban, 2001, p. 179-180). Russell, Bebell, and Higgins (2004) pointed out that although the studies by Cuban (2001) found technology not widely used in the classroom despite its presence, none of those studies involved ubiquitous laptop environments. Many of the studies by early researchers in ICT focus on the declining ratios of computers to students (Cuban, 2001). By contrast, the amount of technology use increases when laptop computers are used in a ubiquitous environment (Brown, 2000; Zucker, 2008).

### 2.2.3 Technopositivism and computer myths

Robertson (2003) believes that teachers are susceptible to technopositivism, an ideology where people have naïve faith in the promises of technology. They tend to be uninformed about the research that has failed to find a positive relationship between ICT use and student achievement. Teachers have been denied the opportunities to question the motives, rewards and power associated with the unscrupulous marketing of ICT. Robertson states that technopositivism is a marketed ideology where marketing strategies appropriate and redefine educational goals and problems.

There is a substantial resistance among certain groups to increases in funding for school technology. For example, Waller (2007) makes a Marxist analysis of ICT education in the UK and questions the view that ICT use benefits teachers and students. Over the last five years, the UK government has spent over £ 2.5 billion on ICT equipment for schools and training for teachers to use technology (Waller, 2007). He states that the significant increase in spending on technology and the promotion of ICT in schools actually benefits capitalism and is a systemic exclusion of visible minorities and

much of the working class. He further claims there is collusion between the global IT industry and the educational state apparatus.

Waller (2007) suggests that there are five myths in introducing technology to education. The first myth is that technology is neutral. Technology is not a neutral tool but a medium with consequences that are significantly shaped by the historical, social and cultural context of its use. The schools are buying hardware and software created and owned by businesses in the U.S. He speaks to the contracting out of the manufacture of the technology to cheap labour in underdeveloped countries and the immigrant workers in Silicon Valley with low pay, no health insurance, nor maternity benefits (Waller, 2007).

The second myth is placing technology in schools and classrooms leads to automatic learning gains. Waller refers to Cuban's (1986) pattern of introducing technology to schools. There are initially promises of improvement backed by the technology developers' research; however, the teachers never really embrace the new tools and no significant academic improvement occurs. This in turn creates reasons as to why the technology is not working such as lack of financial resources, teacher resistance or school bureaucracy with the result that few people question the validity of the claims of the technology advocates (Waller, 2007).

Waller asks the question, why is ICT any different than other previous machine technologies and will this cycle be any different than those Cuban describes? Waller (2007) found in the study of teachers in nursery and infant schools that there is little evidence of ICT impact on children's learning. Despite this, the UK government has supplied every nursery school with an electronic whiteboard even though these were not requested by the teachers nor were they trained in how to use them. There has been limited evidence found in the successful use of electronic whiteboards in early class years (Miller et al., 2005; as cited in Waller, 2007). One problem with interpreting Waller's critique is that there was no reference to the amount of professional development given to teachers using the electronic whiteboards.

In the latter part of Cuban's technology development cycle, he claims that the teachers are often blamed for the lack of impact. The statement, "a key concern is the extent to which teachers fail to appreciate that learning and teaching through technology

requires a new approach to pedagogy, to planning and preparation and how to how the curriculum is perceived" (Becta, 2006a, as cited in Waller, 2007).

The third myth that Waller states is giving teachers access to educational technology makes them more professional and efficient. He claims there is no evidence that ICT reduces workload, nor makes them more professional and efficient (Becta, 2004b, as cited in Waller, 2007).

Pricewaterhousecooper's (2001), study of teachers' workload (as cited in Waller, 2007) acknowledged that the number and pace of educational initiatives over recent years had placed additional demands on teachers. Apple (2003, as cited in Waller, 2007) has argued that the reliance on prepackaged software can cause a loss of skills as local curriculum planning becomes obsolete. Teachers using online curriculum become disempowered in that they are effectively just the implementers of someone else's plans.

The fourth myth is equipping schools with increased ICT leads to school improvement. There is a myth that the e-confident teacher is equated to being an excellent teacher and also a successful school is an e-confident school (Waller, 2007). Technology alone however, will not make a poor teacher a better teacher.

The fifth myth is that students need to have technological literacy in order to be employable. Waller (2007) states that, although the government suggests that society is becoming increasingly dependent on ICT knowledge and skills there are also a number of computer specialists who are unemployed. He argues that as digital technology is constantly developing to meet the needs of capital so technological literacy itself is also constantly changing.

One of the other concerns that Waller (2007) raises is the expectation that teachers will continue to use ICT in their teaching and administration with the focus on e-learning and e-confidence which then leads to an intensification of teachers' workload and a blurring of the work/life divide. Each one of Waller's claims has some validity, but rather like the very pro-technology studies, each side seems to resort to a very polarized view, and the data is still emerging. Rather than taking a position on one side or the other, it makes for better research to remain open to new data and findings.

One fact does seem to be the case however, and that is that once technology is introduced into a society, rarely does it leave (Diamond, 1995). If one is to adopt ICT

technology for teaching and learning in schools, and society, then it is worthwhile using it efficiently, productively, and creatively.

> Though not all teachers have embraced these new technologies for a range of reasons—including a fear of change and lack of time and support—the fact that these technologies are here to stay cannot be doubted. Moreover, the rapid rate of evolution of these new digital technologies prevents them from becoming 'transparent' any time soon. Teachers will have to do more than simply learn to use currently available tools; they also will have to learn new techniques and skills as current technologies become obsolete. (Mishra & Koehler, 2006)

### 2.2.4 Positive and negative effects of ICT on student achievement

Schacter (1999) completed a meta-analysis to summarize the positive and negative impact of technology studies on student achievement. He examined Kulik's (1994) meta-analysis on more than 500 studies on computer based instruction and found the positive effects included students who used computer based instruction scored at the 64$^{th}$ percentile on achievement tests, learned in less time, liked their classes more, and increased their positive attitudes. Unsurprisingly, however, computers did not have positive effects in every area in which they were studied.

For example, Schacter (1999) summarized Sivin-Kachala's (1998) review of 219 research studies and found that students in technology rich environments experienced positive effects on achievement in all major subject areas and improved attitudes towards learning. However, the effectiveness of ICT is influenced by the nature of the student population, the particular software under study, the educator's role and the level of student access to technology (Schacter, 1999).

A study in Northern Ireland in 1991-92, found that the impact of laptops after one year was "at best marginal" on achievement in mathematics, science and writing (Gardner, Morrison, Jarman, Reilly, & McNally, 1993). Some of the concerns of the students included the heavy weight (5-7 lbs) of the computer. As well, while the students were able to take the laptops home, this practice was stopped at one school after the machines were continually forgotten, and not being recharged at home by the students. By the end of the project there was a consensus that the teachers as well as administrators should also have a laptop; however, there were concerns that these costs would be too much to the school board. Principals of the schools, when asked about having one laptop per student, called it "horrifying", because of the resource management problems.

Teacher ICT literacy improved somewhat over the course of the project but teachers still remained partially unfamiliar with the technology and it was not clear if they received any training (Gardner et al., 1993).

Gardner et al.'s study is an interesting early investigation that would be worth replicating in this era of Internet accessibility, wireless access, lighter laptops, and more available educational software. Initial professional development on integrating laptop technology for teaching would probably be of greater benefit now to both teachers and students. However, having the teachers learn about the computer at the same time as the students taints the research findings on this study. The computer as a tool requires proficiency to maximize its benefits (Urbain-Lurain, 2000). There was no indication if teachers taught basic computer skills such as touch typing in this study.

Stevenson (1998/1999) in a study of grade 5-7 students with laptops in Beaufort County, SC, found that 75% of students used laptops in school, while 97% of students completed assignments at home with them. Laptops were associated with academic gains, including improved spelling skills, and writing skills as well as fewer days absent and less tardiness. There was enhanced interaction with other students and a maintained level of academic achievement while non-participants experienced a decline in standardized achievement levels. It was found that the use of laptop as notebooks was associated with sustained level of academic achievement over time. The question posed by school boards in the discussion of the study, "Where should limited resources be expended?", cannot be directly answered by the findings (Stevenson, 1999). There was no indication that teachers received any professional development for teaching nor that computer proficiency skills were taught. Cost was a key issue raised and is one of the main factors affecting whether or not students should be provided with laptops.

In a meta-analysis on 26 research studies that compared students writing ability using computers vs. paper and pencil, Goldberg, Russell and Cook (2003) found that there was a significant mean effect favouring the use of computers for quantity and quality of writing as well as more student engagement and motivation in their writing. They suggest that the computer is a valuable tool for teaching student writing. One of the studies suggested that the slow speed of students word processing on computers compared to writing on paper was due to the lack of keyboarding skills.

In a systemic review of research on the effects of ubiquitous computing on student learning, Bethel, Bernard, Abrami and Wade (2007) found mixed results on the effects of computers in schools that ranged from positive to marginal or lack of effect, to harmful. Bethel et al. (2007) found that ubiquitous computing in schools have "shown improvements in technology integration, use and proficiency, in attitudes towards technology and the promise of technology for learning, and to some extent increased engagement and motivation." (p. 5). However, laptop programs do not always lead to increased student achievement. Only six out of the fourteen studies showed evidence of student achievement gains, four of which had well-designed studies yielding reliable data while eight demonstrated no significant difference in results (Bethel et al. 2007). Positive results were shown for writing assessment and problem solving when teachers received prior integration training using iNtegrating Technology for inquiry (NTeQ), a model to develop problem based lessons for students using authentic learning including teaching research and writing skills (Lowther, Ross & Morrison, 2003). Although there is some positive data on achievement gains with one to one computing in schools, it is more likely to occur when teacher professional development activities are implemented. Hence there seems to be evidence that there is a need for effective preservice teacher training of ICT integration in ubiquitous computing. The question, "Should achievement gains be the justification of the use of the laptop in schools?" leads into another area of discussion in demonstrating the efficacy of the laptop.

### 2.2.5 Standardized testing as the benchmark tool

There is a complex link between standardized tests, school improvement and the expected gains in learning with the use of the computer. Some educational reformers feel that school improvement can be simply measured by an increase in standardized test scores, which has been supported with the increased amount of testing mandated in the No Child Left Behind legislation in the United States. The test scores are often tied to funding models and teachers have been 'teaching to the test' (Zucker, 2008).

Cuban (2001) believes that in the mid 1980's, educational reformers expected higher standardized test scores, meaning rigorous academic standards and accountability, from the increased use of the computer in schools. Cuban (2001) concludes the link between computer availability and test improvement scores is not clear, as well, the

amount of money and time spent, has yet to yield even modest returns to what had been promised in academic achievement. However, the expectations of educational change, such as higher test scores, as stated by Cuban (2001), is refuted by Zucker (2008) in that many people did not believe the utopian rhetoric, and he claims that technology will change some educational practices while others will remain the same.

The difficulty arises in that many students have often been writing the standardized tests with paper and pencil. Zucker (2008) suggests that it would make sense to test students, who have learned to write with a word processor, to be evaluated using a computer. Goldberg, Russel and Cook (2003) in their meta-analysis found there was an increase in quality and quantity of writing among students who consistently wrote with computers. A paper and pencil test is not a good evaluative tool in measuring the proficiency of computer use (Sandene, et al. 2005). Often the efficacy of the computer in a classroom has been measured by the scores of a standardized test that has been written by hand (Zucker, 2008).

Hill, Reeves, Wang, Han, and Mobely (2004) found that achievement scores of students in the ubiquitous laptop program at Athens Academy were high already and it would thus be unrealistic to expect higher scores. As well, “From an historical perspective, it seems unrealistic to expect that the use of technology will have an impact on achievement on traditional measures (e.g., standardized tests) when the activities that learners engage with the technology are not ‘traditional’.” (Hill, et al., 2004, p. 16).

The concern of computers vs. paper-based assessment in standardized testing has been studied in the United States (Sandene, et al., 2005). The study is worthwhile in fully understanding the complexity of the integration of computers and standardized testing. Some findings from the study indicate that computerized standardized testing is feasible in mathematics. Although the majority of the students (86%) indicated that they had familiarity with computers, many had difficulty with computer proficiency because they lacked keyboarding skills. Some bias was noted by evaluators in that they may be more forgiving on hand written compared to electronically written papers.

Standardized tests are useful as an admission requirement for colleges, as it is thought to create a level ground among applicants who come from many different geographic areas. However, standardized tests at the school level vary in regions as

curricula vary, and the validity of the test depends on so many other factors (Zucker, 2008). The research appears to indicate that there is some question in evaluating the success of the computer as a tool in the classroom solely on academic achievement measured by standardized tests, as education involves many other integrated social factors.

### 2.2.6 Complexity of trying to improve educational outcomes

Cuban (2001) suggests that the advent of personal computing led to high and unrealistic expectations of its potential toimprove education. This unrealistic value invested in the potential of computers as the effective means to solve long-standing educational problems has been hard to change.

Assessing cause in complex, multi-dimensional environments like education is challenging. What works in one situation may not work in another due to the multitude of variables in the mix. These include students of different cultural and socioeconomic backgrounds, ages and level of computer experience (Albion, 2001). Additionally, older students may have better keyboarding skills (Goldberg, Russell &Cook, 2003) than younger students. Teacher experience and comfort with technology and their beliefs about how to integrate technology into their teaching offer another set of significant factors to consider, as does the variation in computer technology; different models, specifications, and software. Finally there are institutional differences, including different levels of technological support within the schools, curriculum variation among provinces, states and countries. Some educational systems have adopted the ISTE NETS standards making ICT an integral part of the curriculum, while areas such as Ontario have general information technology skills embedded in their subject area curricula, but do not have a set of independent standards (Rozanski, 2002).

### 2.2.7 Comparing laptop ubiquity with periodic use

A study of preservice teachers at the University of Southern Queensland found that the amount of time spent using computers was the factor that contributed the most to the variance in self-efficacy for computer use (Albion, 2001). The more time spent with a computer, the more comfortable people became in using them. There was no indication that the university had a laptop program but this study was included to introduce the concept that the proficiency of the computer can improve with more frequent use.

There has been debate by some education faculty who feel that a desktop computer would be just as effective as the laptop as a learning tool (Scott, 2005). However, in asking preservice teachers in a laptop program the difference between desktop and laptop, they favoured a laptop due to; access to computer due to portability, access to research/information, ease of assignment completion, access to educational software, ease of email communication with friends and faculty, developing lesson plans and collaboration with peers in group work (Weeks & Kariuki, 2003). These benefits were also listed by Brown (2000), as well as students are not limited to computer lab hours and the standardization of laptops and platform creates an equitable learning environment for all who have one (Brown, 2000).

What sets the wireless laptop apart from the desktop computer is its portability. McLuhan (1962) comments, “The portability of the book, like that of the easel-painting, added much to the culture of individualism.” (p. 206). He states just as easel painting deinstitutionalized pictures, the printing of the book broke the monopoly of the library. In an individualistic society, the development of innovations provides people with the freedom to be individuals. Many people prefer the car instead of mass transit. The land phone line is being overtaken by the popularity of the cell phone. The increase in laptop sales is overtaking the desktop computer (CBC, 2008). The laptop is a tool that also contributes to individualism but also has the capacity to reach everyone in the global village (McLuhan & Fiore, 1967).

An advantage of the ubiquitous laptop program in a school setting is that students have access to laptops whenever needed during the day or at home. The assumption is that such increased computer access will lead to greater use of ICT, and ultimately greater learning. Russell, Bebell, and Higgins (2004), completed a study where grade 4-5 students in the same school could have a laptop to use all the time, in class and at home, and another group just had use of the laptop in a shared cart to be used in class only. The cart was brought into the classroom for a one-week period once every five weeks. All teachers had in-servicing once a week to learn how to use the laptops, trouble shoot problems and integrate technology into the curriculum. Results showed that the 1:1 classes used technology more frequently, in different ways and in all subject areas. The ubiquitous class used the computer as their primary writing tool and composed text more

frequently on the computer than the shared cart classes. Students in the laptop classrooms were observed peer conferencing two times more frequently than shared classrooms, used computers more for academic work at home, and had higher motivation and engagement (Russell, Bebell, & Higgins, 2004).

The Russell, Bebell, and Higgins (2004) study indicates that ubiquitous laptops will result in more use of technology. The effectiveness of the study can be questioned because the teachers were learning about the technology at the same time as the students. If the teachers had some prior experience in integrating the technology into their teaching, how much more use of technology would be used? It did not indicate if the students were taught keyboarding skills or the level of proficiency of keyboarding or word processing. Effective keyboarding skills, a primary skill in computer proficiency, would facilitate writing with the word processing programs.

### 2.2.8 Importance of keyboarding as a basic skill

One of the basic skills in effective computer use is keyboarding. The proficiency in developing any skill, including fine motor skills such as writing with a pencil, or keyboarding is practice. Skill also requires being taught with an effective technique supervised by someone who has followed a proven method of proficiency (Rogers, 2006). The computer does have the capability of being used without or with a low level of keyboarding skills, but to conduct studies in determining the efficacy of the computer in education without addressing the prior keyboarding skills of the students limits the potential benefit of the computer. Of the many studies that have been done on the computer, keyboarding is often only indirectly considered.

Teaching writing at the early grades involves having students spend time on letter formation and repetition of letter formation first in printing then in cursive writing. First accuracy is encouraged and then proficiency develops over time with practice. Cursive writing probably developed over printing as a faster method of communication (McLuhan, 1962) and both are taught in the schools. However, keyboarding, the skill needed for efficient computer use and word processing, is not included as mandatory skill in the Ontario elementary curriculum. It is included as a small part of an optional technology course and a business studies course at the grade 9 level in the Ontario curriculum (Ontario Ministry of Education, 1999, 2006). In many US states, by contrast,

keyboarding is included in the elementary curriculum as part of the ISTE NETS (2004) and is on the increase (Rogers, 2006). Many studies with students working with computers, such as Russell et al. (2004) do not state the level of proficiency of keyboarding skills. The use of the computer is greatly enhanced with the skill of keyboarding (UNESCO, 2002).

UNESCO (2002) recognizes the importance of keyboarding as a skill to be learned by the student if they are to work in any professional environment:

> In completing projects, students must demonstrate technical skills that may be applicable in a variety of professional environments. For example, today one of the most urgently needed skills is computer keyboarding. The achievement of typing speed which is higher than the speed of writing with a pen on paper typical of an average adult requires much less time and effort than is usually spent by children during the mastering of the basics of calligraphy. Hence, there exists the possibility to develop the child's communicative abilities not only after the development of psycho-motor writing habits is complete, but also in parallel, and even ahead of the latter. (UNESCO, 2002, p.189)

Hoot (1986), found studies as early as 1932 (as cited in Rogers, 2006) showing that students who typed their work on typewriters were shown to have greater gains in all subject areas than those who did not type their work. Without the teaching of keyboarding skills, people develop their own system and they take longer at the computer. Teachers have taught students to retrieve information on computers, but not all have taught how to type on the keyboard with the touch type technique using the homerow (Rogers, 2006).

Traditionally, keyboarding was only taught in business courses to girls who were entering the secretarial workforce. In Sormunen's 1991 study (as cited in Rogers, 2006) of elementary teachers who were teaching keyboarding, only 12% had any formal training in teaching keyboarding. Rogers (2006) lists the improvements of students who have been taught the touch method of keyboarding; improvement in: 1) language arts, reading, spelling and writing ability; 2) efficiency in using the computer as a writing, editing and computing tool, therefore maximizing classroom time; 3) attitude toward writing (less frustration in looking for keys rather than entering information); 4) prevention of bad keyboarding habits for later word processing and computer applications; 5) motivating all students toward doing homework; 6) creative thought; 7)

integrating keyboarding with all subject areas and 8) preparing all students for a technological society (Rogers, 2006).

The National Educational Technology Standards (ISTE NETS, 2004) lists keyboarding as a skill to be taught at the elementary level and Erickson's 1993 study (as cited in Rogers, 2006) suggests grade 3-4 is a good age to start as students have, by that age, developed the fine motor skills, hand-eye coordination and reading ability to succeed at keyboarding.

There are software programs to teach and assist teachers in the teaching of keyboarding; however, observation of students by a knowledgeable instructor is essential to assess correct techniques of the touch method of keyboarding (Rogers, 2006). "Keyboarding skills are as basic to learning as penmanship in this technology-driving world" (Rogers, 2006, p.1). Yet, many studies in determining efficacy of the computer have not considered the keyboarding skills of the subjects as a variable.

### 2.2.9 The Matthew Effect

"The Matthew Effect" was first coined by R. Merton (1968, 1988) in reference to how famous scientists, who were Nobel laureates, were cited more often in the literature because they were famous. These scientists received a disproportionate amount of credit for the work they did while many other comparable but lesser known scientists received disproportionately less recognition for their work. He derived the phrase from the gospel of St. Matthew in the parable of the talents, "For unto every one that hath shall be given, and he shall have abundance: but from him that hath not shall be taken away even that which he hath." Matthew 25:29 (Merton, 1968).

The use of the analogy of the Matthew Effect has been used in many disciplines including welfare economics, social policy and administrative studies (Merton, 1988). Stanovich (1986) extended the concept of the Matthew Effect within education, specifically in reading to describe how greater practice in reading leads to an increased reading ability and similarly, someone who does not read as easily will read less and thus not develop stronger reading skills. Early readers therefore tend to become better readers. The general case of the Matthew effect is that the more the tool is used the more proficient one becomes at it.

The mobility of the laptop computer enables both preservice teachers and faculty to carry it with them all the time, from classes to home (Weeks & Kariuki, 2003). If the computer is available for use more than the 12 hours in a classroom, there is a greater chance of increased skills, increased confidence in using the computer, and in the case of preservice teachers and faculty, perhaps the better chance of integration of ICT within their teaching (Weeks & Kariuki, 2003). Therefore the Matthew Effect, the success derived from increased use, can apply to the ubiquitous laptop program.

## 2.3 Results with laptop programs

The studies of laptop programs in faculties of education can be categorized into three broad focus areas; 1) an examination of the implementation of the laptop program (Stewart, 2003; Weeks & Kariuki, 2003; Resta, Abraham, Gerwels, & Tothero, 2004; Waker, Robert, Babcock & Columbo, 2004; Resta, 2008); 2) studies of the experiences of preservice teachers (Kariuki & Turner, 2001; Weeks & Kariuki, 2003; Kariuki & Knaack, 2003; Petrie, Hill, & McCoy, 2003; Reed, 2003; Thompson, Schmidt & Davis, 2003; Weeks, 2004; Kay, 2004; Kay & Knaack, 2005; Rader, 2005; McKimmy & Leong, 2006; vanOostveen, Hunter, Kay & Muirhead, 2007; Kay, 2008); and 3) the faculty experience in teaching in a ubiquitous laptop Faculty of Education (Stewart, 2002; Scott, 2005; Bin-Taleb, 2005; Leong & McKimmy, 2006) although some of the studies do overlap in description as they are closely related.

### 2.3.1 Teaching ICT in teacher education

There are a variety of methods of teaching ICT in teacher education programs. Kay (2006), in his meta-analysis, evaluated 68 refereed journal articles that dealt with strategies in integrating technology into preservice education and found that there were ten key strategies used. These strategies include delivering a single technology course; offering mini-workshops; integrating technology in all courses; modeling how to use technology; using multimedia; collaboration among preservice teachers, mentor teachers and faculty; practicing technology in the field; focusing on education faculty; focusing on mentor teachers; and improving access to software, hardware, and/or support. He noted that most studies looked at programs that incorporated only one to three strategies. When four or more strategies were used, there appeared to be a greater integration of technology (Kay, 2006).

On the research itself, Kay (2006) comments on the amount of studies that have been done, as well as the quality of the research method used in the evaluation process. Kay decided that many of the studies "had severe limitations in method; poor data collection instruments, vague sample and program descriptions, small samples and an absence of statistical analysis or weak anecdotal descriptions of success" (Kay, 2006, p. 1). Kay (2006) lists the following recommendations for future researchers of technology in preservice teacher education programs and they will be considered in this study.

> 1. a clear description of the sample including, as the minimum, number of students, age, gender, and teaching level;
> 2. a comprehensive description of the education program including number of years of study, number of students, and organization of the program with respect to the use of technology;
> 3. reliability and validity estimates of any data collection instruments used
> 4. both qualitative and quantitative data;
> 5. formal analysis of individual differences if the sample size is large enough, and
> 6. measures that look at attitude, ability and use in the same study. (Kay, 2006, p. 401)

Kay and Knaack (2005) listed activities that integrate technology which included: a) discussion boards for assessment, (using a discussion board to provide feedback to colleagues), case studies, (preservice teachers work in groups to solve problems with the use of a discussion board), online debates (preservice teachers are divided into two teams and then research and post their arguments on the discussion board, b) electronic portfolios to showcase student work, c) online evaluation tool, such as questionnaires, tests or exercises for immediate evaluation after a lesson, d) Java Applets, used for practice exploration and demonstration, e) labs, subject specific software in Mathematics or Science, f) research topics using the Internet, g) creating collections of resources from existing web pages, h) streamed videos in various disciplines, i) creating mini video clips on various topics, j) designing a web page and shared with colleagues, and h) web quests, (Kay & Knaack, 2005). Kay and Knaack (2005) identified seven different models used to teach technology to pre-service teachers; single course, integrated, modeling, field based, community based, multimedia and combined. Russell et al. (2003) indicated the enriched opportunity preservice teachers receive when ICT skills are taught as well as modeled:

> Teacher preparation may be enhanced by creating opportunities for teachers in training to see and experience the positive effects of technology on teaching and

> learning. We feel it is of great importance to supplement the efforts to teach the mechanics of technology with exposing teachers to examples of technology integrated into the curriculum and classroom. (Russell et al. 2003, p. 308)

To maintain currency, professors have to stay current with the technology being used in the classroom, be aware of the practical applications and be able to teach what technology is useful and successful to make it worthwhile for the preservice teacher (Russell et al., 2003). There is, however, still hope for older but possibly less experienced, teachers in the integration of technology into teaching.

> …teachers who have entered the profession during the past 5years use technology significantly more for preparation than do teachers who have taught for 15 or more years, but when it comes to technology use during instruction, new teachers require students to use technology during class time significantly less than for teachers who have taught for 6 or more years. It is interesting that there are no significant differences among the three groups in terms of technology use to deliver instruction. (Russell et al. 2003, p. 308)

### 2.3.2 Integrating ICT into a Faculty of Education through modeling

Preservice teachers learn most of their teaching skills though the modeling of teacher educators (Lortie, 1975). “While learning technology skills is necessary, it is crucial to model to preservice teachers the way technology integration can look like.” (Kariuki & Duran, 2001, p. 1).

Mullen (2001), in a study of four preservice mathematics teachers’ beliefs about the role of the computer for teaching and learning came up with a number of suggestions, including modeling, to improve the use of teaching with technology. The suggestions include a) providing new visions of curriculum instruction for preservice teachers with an opportunity for reflection, b) an infusion model of technology for instructional purposes, c) a faculty commitment to provide modeling of curricular experiences in their own instruction of preservice teachers d) providing field experiences where preservice teachers can view and engage in teaching and learning with computer technology, (which may include more ICT training for associate teachers) and e) more effective pedagogical reasoning where strategies used are adapted to the characteristics of the learners. A combination of methods and experiences provide a better background in ICT integration (Mullen, 2001).

The CEO Forum on Education & Technology categorizes the competence and use level of faculty as a series of developmental stages similar to what the Apple Classrooms of Tomorrow rate the levels of teacher expertise. The levels are listed:

> *Entry*: Educators struggle to learn the basics of using technology;
> *Adoption*: Educators move from the initial struggles to successful use of technology on a basic level;
> *Adaptation*: Educators move from basic use of technology to discovery of its potential for increased productivity;
> *Appropriation*: Having achieved mastery over the technology, educators use it "effortlessly" as a tool to accomplish a variety of instructional and management goals; and
> *Invention*: Educators are prepared to develop entirely new learning environments that utilize technology as a flexible teaching and learning tool. They begin to "think with technology," designing new ways to solve learning problems that their students may have faced in the past. (CEO Forum on Education & Technology, 2000, p. 12)

Urbain-Lurain (2000) prefers the term Fluency with Information Technology (FIT) rather than computer literacy. People who are FIT have coping skills and an understanding of ICT that enables them to make the tools more useful to them.

### 2.3.3 Different kinds of ubiquitous laptop programs

There are different approaches taken to achieve ubiquitous computing in teacher education. At one end of the spectrum of approaches the whole educational institution can have laptops, for example; Acadia University (Cook, Bobbitt, Cunningham, Dayler, Hartman & Hodder, 2006), University of Ontario Institute of Technology (Kay & Knaack, 2005) in Canada, University of Minnesota at Crookston (Lim, 1999) and Wake Forest University (Brown, 2000) in the United States, University of Strathclyde (Thornbury, Law, & Henderson, 2003), in Glasgow, Scotland, and Zayed University, Abu Dhabi, UAE (Kontos, 2001). These institutions also have a Faculty of Education or a Teacher Education program. Rader (2005) lists a few colleges of education in the United States that have implemented ubiquitous computing including; Ball State University, California State University at Sacramento, Wayne State University, University of Missouri, Stillman University, Brigham Young University, University of Houston, and the University of South Florida.

A variation of ubiquity is when only the teacher education program in the university is a laptop program, such as the Bachelor of Education at Nipissing University

(Stewart, 2003, Weeks & Kariuki, 2003; Kariuki & Knaack, 2003; Weeks, 2004), and the College of Education at the University of Texas at Austin (Resta, 2004; Scott, 2005; Bin-Taleb, 2005).

In the Education Division at King's College, Wilkes-Barre, Pennsylvania, the laptops are carried around on a cart (Drazdowski, 2003, 2004, 2005) and brought into an education class for a particular ICT activity. This laptop approach may not be much different than having a computer lab that is portable. The laptops are locked up in a room until the next time the professor chooses to use them in the class. This particular type of laptop learning system does enable any class to become a computer classroom and this would mean that either the laptop batteries would have to be charged or there are enough electrical outlets to maintain power. A wireless system would have to be present to support Internet use. This laptop system is not considered a ubiquitous laptop program as the preservice teachers do not experience the freedom to learn on the laptop 'anywhere anytime', as access to the laptop is limited to class time. Lessons can be learned from this type of ICT experience that could be applied elsewhere but this system has unique advantages and challenges compared to a totally ubiquitous laptop program. The University of Alberta, Faculty of Education has a similar mobile computer lab or cart enabling more classes to obtain computer access while the fixed labs are monopolized by full-term bookings for a few courses (Davies, Carbonaro, & Boora, 2004).

There is also a claim of ubiquitous computing where only a small number of preservice teachers out of the total body have laptops. Cooper and Jones (2003) in a Mid-west inner city public school district and a local state supported school conducted a qualitative and quantitative study of a cohort of 19 Special Education preservice teachers who were loaned laptops from the university to use in their coursework and in the field placement. The lessons learned are important, as they found an effective increase in technology integration in the use and knowledge of technology to support education and in preparing the candidates to integrate technology in a diverse population. The study states that the university was faced with classrooms that lacked infrastructure for technology and the decision to use laptops was to ensure accessibility and flexibility. It did not state if the faculty were provided laptops but does state that workshops were provided for faculty and candidates on the use of technology and to design courses that

integrated technology. It does not state the number or length of workshops or if faculty were required to attend. There is no mention of Internet connections or wireless access. Data was collected through end of year surveys (Cooper & Jones, 2003). A laptop program where not all preservice teachers had laptops or Internet access would not be considered full ubiquity.

Penuel (2006), in a research synthesis of studies that analyzed implementation and effects of laptop schools, defines one to one computing as having three characteristics 1) students have use of portable laptops with software (word processing, spreadsheet tools, etc.), 2) Internet access with wireless networks, and 3) a focus on the use of laptops to complete academic tasks including assignments, tests and presentations.

### 2.3.4 Historical perspective

Laptop programs are a recent phenomenon that has shown dramatic growth. Drew University in Madison, New Jersey in 1988 began providing notebook computers to all incoming freshman (Belanger, 2001). The world's first educational institution that implemented ubiquitous laptops for all students and faculty was in 1993 at the University of Minnesota Crookston (UMC) (Lim, 1999). Brown and Petitto (2003) state that as of 2003, there existed over one hundred laptop campuses in the United States and Canada. By June, 2008, it has grown to approximately 242 colleges and universities that have either campus wide efforts or single programs with ubiquitous laptop initiatives. Brown (2008) has kept an active website list of higher educational institutions that have some kind of notebook or laptop computer initiative. On analyzing Brown's (2008) website, it was found that 49 universities had a teacher education program according to websites of the educational institutions listed. Three of these were in Canada, Acadia University, Nipissing University and University of Ontario Institute of Technology. Three were in the United Arab Emirates and 44 were located in the United States (Brown, 2008). There are no educational institutions listed for other parts of the world. Although there are a number of schools with laptop programs, an electronic search in June, 2008, found no studies of preservice teacher education programs with ubiquitous computing in Australia or New Zealand.

There are a few teacher education institutions that have published research on the status of the laptop program. Many were on the laptop program as a whole, and a few

were specific on an aspect of the laptop program such as Rader (2005) who looked at foreign language preservice teachers at the University of Texas at Austin and Kay (2008) who looked at emotions of preservice teachers in the laptop program at the University of Ontario Institute of Technology.

#### 2.3.4.1 University of Minnesota Crookston

Lim (1999) completed four studies from 1993 to 1999 at the University of Minnesota Crookston (UMC) on how faculty and students view the benefits, impact and integration of ubiquitous laptop computing into classroom teaching and learning. The online survey was given to all participants in the laptop program throughout the university and although an Early Childhood Education program exists, when checking the website in 2008, there was no separation of survey results by program.

Historically, UMC was the first in the US to have ubiquitous laptops for the entire campus and was a model for many other laptop initiatives. No external funds were used in the implementation of the initiative. The students paid a technology fee of $960 for a leased laptop for the school year (Lim, 1999).

Some of the problems in implementing the laptop program include the need for more staff in the summer to prepare for the new school year as the technology changes and required upgrading. These changes caused some technology fatigue among some faculty members. The lack of time required to develop ICT enhanced courses by faculty was a major concern at the university. Less than 25% of faculty members attended training sessions to create technology-enhanced courses. There was no release time or incentives for faculty. What is not mentioned here, which has been common to many laptop universities, is the off task behavior of students in the classroom. There is no mention on how the students connect to the Internet. It is uncertain if wireless technology was available by 1993-1999 (Lim, 1999).

#### 2.3.4.2 University of Texas at Austin

There are several studies completed at the University of Texas at Austin which in 2002 started, a ubiquitous laptop program, the Laptop Initiative for Future Educators (LIFE), in their College of Education. The studies include the following; Resta, Abraham, Gerwels, and Tothero, (2002) on establishing a ubiquitous computing environment for teacher preparation students and faculty. Scott, (2005) studied the College of Education

faculty's approach to learning. Resta, Tothero, Gerwels and Gerling (2005) completed a year two study on establishing a ubiquitous computing environment for teacher preparation students and faculty. Bin-Taleb (2005) studied faculty and preservice teachers' perspectives on teaching practices and the learning environment. Resta, Scott, Bin-Taleb and Tothero (2006) studied the creation of a pervasive computing environment in teacher education specifically looking at the differential experiences and perspectives of preservice teachers, faculty, and support staff. Resta (2008) used activity theory framework for implementing a laptop initiative in teacher education.

Scott (2005) completed a doctoral dissertation on the College of Education faculty's approach to teaching and learning at the University of Texas at Austin. Scott (2005) stated that there is very little known about how laptop programs are changing faculty approaches to teaching and learning and there is a need to hear the stories of faculty of education professors who integrate ICT into teaching. She states that studies on education faculty experiences in ubiquitous computing are largely unexplored. The questions that Scott (2005) answered are what events or knowledge has guided the successful implementation of laptops as teaching and learning tools, what is their perceptions of the process and how they adapt to the change, and what changes are required by teachers, administrators, students and other stakeholders before ICT can be fully integrated into all education? The faculty stated that the ICT improved communication, the mobility of the laptops gave 'anytime, anywhere' freedom to work on assignments, and engage in faculty and preservice teacher reflections. Some of the concerns the faculty expressed include; lack of time to learn the technology, the breakdown of the technology, the fact that learning the technology does not get them any closer to tenure, and that the off task behavior of the preservice teachers in the classroom (surfing the net, and checking email). One faculty member felt that the students were off task and did not know the material as well as previous years without laptops. There was some concern that the focus on technology was displacing teaching goals as the primary educational focus, the mixed results of the use of PowerPoint for content delivery. The faculty members were concerned that the schools would not have the technology resources to support the use of ICT in the classrooms (Scott, 2005).

Bin-Taleb (2005) studied faculty and preservice teachers' perspectives on teaching practices and the learning environment in the College of Education at the University of Texas at Austen as a doctoral dissertation. The laptop program was initiated in 2002, with 361 preservice teachers and 48 faculty surveyed in the fall of 2004. Results from the survey indicate that faculty perceived the impact of the laptop initiative more favorably than did the preservice teachers. The positive aspects of having a ubiquitous laptop included: convenience, help in planning courses and doing assignments, ease in conducting research, ease of online communication, improvement in note taking by students, and help in staying organized. The issues and concerns raised by some faculty and students include: the potential of laptops to distract students during lectures, lack of effective utilization in some classrooms, the need for more training and technical support, and the cost of the computers. The study suggests improvements of the laptop initiative which included: adequate institutional support, orientation sessions for students entering the program, additional technical support and regular training sessions are needed for faculty to become proficient and utilize ICT across the curriculum.

It was recommended that the university should reevaluate the cost of the computer and software as well as inform learners about why they are required to buy a laptop and explain the benefits of using it. Having the students buy any laptop they like would help as well. Off task behavior was a concern and some suggestions include limiting Internet use in the classroom, limiting the number of students in a class, and offering more break time so students can surf the Internet and check email. An incentive plan (either monetary or release time) for faculty to use laptops in their classrooms was recommended as the laptops were not used uniformly in classrooms. The rewards may encourage reluctant faculty members to integrate the use of laptops into their teaching.

There is a need for research in comparing the effectiveness of teaching with laptops as compared to traditional classrooms, focusing on learning outcomes. "Teaching and learning with laptop computers will never be completely accepted in the higher education community until considerable evidence of the efficacy of laptop computers in this setting is provided." (Bin-Taleb, 2005, p. 184).

Rader (2005) completed a doctoral dissertation on a cohort of seven foreign language preservice teachers at a College of Education at a large university in the

southwest United States with a laptop program that started in 2002. She used interviews, questionnaires and observations to study the experiences of the preservice teachers. Ely's (1999) model of successful implementation of technological innovation was used as the framework for the thesis. Ely (1999) suggests that there are eight conditions that appear to facilitate the implementation of educational technology innovations: 1) dissatisfaction with the status quo, 2) existence of knowledge and skills, 3) availability of resources, 4) availability of time, 5) rewards or incentives 6) participation 7) commitment and 8) leadership. The preservice teacher's experience was enriched by the computer skills and knowledge they acquired as a result of the laptop program, the exposure to models of teaching by professors and teachers in the field as well as the availability of ICT resources in the schools. Rader's (2005) findings support previous research that preservice teachers must be placed in technology rich environments to connect their ICT training with sound pedagogical practices in an authentic setting.

Some recommendations were specific to the university where Rader worked and include; administration should be aware of the particular ICT needs of specific curriculum subject areas; ICT skills of the preservice teachers should be strengthened earlier in the program; more collaboration between the language departments and the College of Education in modeling how to integrate ICT into the teaching of languages; and provision of ICT resourced schools for field placements (Rader, 2005). She also found that some preservice teachers were concerned about the cost and did not like the idea of having to buy a laptop when they already had one (Rader, 2005).

Resta et al. (2004) describes the key elements in setting up the laptop program at the University of Texas at Austin and shared the lessons learned in planning and implementing the initiative. All preservice teachers were required to purchase a prescribed laptop and software with faculty and clinical supervisors provided with the same computer and software. Both the College of Education building and public school classrooms where preservice courses were taught had a wireless environment. The evolution of the laptop program was in response to; meeting and exceeding the standards for integrating technology into teaching and learning, acknowledging the previous limited access to computers by preservice teachers and faculty, the belief that faculty modeling of

instructional strategies with computers would encourage adoption by future teachers and several years of pilot efforts that suggested increase usage of ICT.

Resta et al. (2004) stated that some of the lessons learned from the administrative perspective include recognizing the importance of pilot work, collaborative planning with university administrators, faculty, students, and local school personnel, negotiating with multiple possible vendors to get an initial discount price that helped persuade people reluctant to change, a partnership with Apple, including the purchase price within the student financial aid packages, and that implementation requires the dedication of core resources for management and faculty curriculum development.

From the faculty perspective, Resta et al. (2004) recommends that willing faculty support is critical, students have to use their computers to complete technology-enabled assignments, and faculty should choose ICT to add value to their teaching. He found that students often know more than faculty about the technology and politely sit through a faculty explanation and complain about it later. What made it a success included excellent support from ICT staff, planning for details such as the number of outlets, and ensuring the preservice teachers saw the benefits in purchasing an expensive computer. Most faculty members now cannot imagine teaching without a laptop.

Resta et al. (2004) suggest, for technical support, to start with one platform, offer basic technology training for preservice teachers and faculty, be prepared to purchase more technology peripheral tools to sign out such as, digital cameras, data projectors, and loaner laptops, protect the institution from liability, back up data regularly, hire additional support staff, pre-load software, and provide wireless access.

Within the field experience, Resta et al. (2004) suggests asking and providing in-service teachers the ICT training they require, pay teachers a stipend at the conclusion of the training series, and provide the ICT tools to teachers to use during the training session. He suggests that education faculty model the effective use of technology in their own classes to ensure that preservice teachers use the new tools for learning in their classrooms (Resta et al, 2005).

In the third year of the program, studies indicate that preservice teachers endorsed the laptop because of convenience, help in doing assignments, help in conducting research, ease of getting resources on the Internet, improved communication, note taking

and organization (Resta et al. 2006). It was found that preservice teachers with three semesters of experience expressed a more positive perception of the laptop than preservice teachers with one semester of experience (Resta, 2006).

Resta (2008) used activity theory to frame the laptop implementation process at the University of Texas at Austin College of Education. It was useful in recognizing the complex interactions of all components of the activity system. The data gathering and analysis was completed for this study prior to the publishing of Resta's (2008) article. The situations are similar in that both universities started with a pilot program in 2002, both have a single hardware platform and standardized software for both faculty and preservice teachers although the University of Texas at Austin also provided laptops for clinical supervisors but the university in this study does not provide laptops for faculty advisors. The University of Texas at Austin College of Education, as well as schools in the United States follow the ISTE NETS (2004) standards that have a certain expectation in ICT usage, for students, teachers and administrators.

#### 2.3.4.3 Iowa State University

Thompson, Schmidt, and Davis (2003) established a Technology Collaboratives (TechCo) for Simultaneous Renewal in Teacher Education project, which involved a comprehensive integration of technology into a teacher education program. The project involved faculty and preservice teachers from the College of Education at Iowa State University, and four K-6 partner schools working together with laptop computers, through faculty development programs, teacher development programs as well as curriculum development. Although there were 1200 preservice teachers, only 2 cohorts of 25 participated in the project, so this would not be a ubiquitous laptop program. Of the 29 full time tenure track faculty members 28 participated in some aspect of the TechCo project. All of the preservice teachers in both groups were female. Nearly 80% elected to purchase their laptops and additional laptops were purchased for preservice teachers without laptops and were used when needed.

The TechCo project recognized that many teachers in the schools were not integrating ICT into their teaching, possibly from lack of technical support or ICT training (CEO Forum on Education Technology, 1999). If a preservice teacher was going into a school frequently they did not have an opportunity to observe ICT integration by

an experienced teacher in the field and the school may not have the technology infrastructure to support what they may have learned on ICT integration in the Faculty of Education. The systems developed in the TechCo project appeared to address this model.

Although the TechCo project was not ubiquitous with all preservice teachers, the model had several strengths regarding faculty development and inservice for teachers. Structures were set up to support the systemic change of ICT integration into teaching the preservice teachers and the students in the school. The TechCo project is based on John Goodlad's theory of simultaneous renewal (1994) where both schools and teacher education institutions change together. There existed a history of deeply collaborative relationships between the schools and the College of Education. The project was not yet completed in 2005 but early signs indicate the importance of three way professional development for university faculty, inservice teachers and preservice teachers, reciprocal mentoring between faculty and graduate students, a master teacher working with both K-6 schools and the university, ubiquitous computer access for preservice teachers, cohort student groups, administrative support for technology integration and adopting the approach of generative evaluation to inform project leadership and systemic change. There is no indication in the article of issues or problems that occurred during the project. The project was supported with a federal grant from the USDE. It is not known how the project ended.

Turner and Kariuki (2001) completed a study on preservice teachers using laptops in a year-long fieldwork experience in an elementary school in the development of an electronic portfolio. The preservice teacher developed confidence in the integration of ICT into teaching and the classroom teacher was taught how to use technology in the classroom. Providing a non-threatening environment facilitated the learning of ICT.

#### 2.3.4.4 Other colleges in the United States

At the Faculty of Education at Pikeville College in Kentucky, a private grant that was received in 2000, provided hardware, software and training to preservice and inservice teachers. Laptops were provided to the Education faculty as well as the preservice teachers. The exit interviews in the last two years with the laptops show an increase in student competency; increases of 9% to 19% on Kentucky state standards and increases of 7% to 14% in subject area competencies. The Education faculty had

intensive technology training and updates on their knowledge and skills of technology integration in the curriculum. Many of the faculty now model technology integration in the teaching and requirements of their courses. There is an increase of preservice teacher scores given on a PRAXIS exam and although it is difficult to prove that the laptop is responsible, many faculty indicate anecdotally that the laptop has helped increase scores (Reed, 2003).

Petrie, Hill, and McCoy (2003) studied a laptop program at the University of Alaska Anchorage Post-baccalaureate Teacher Education Program where 20 preservice teachers received through PT3 grants a laptop computer. They used the laptop in preparing an electronic portfolio and a multi-media presentation to meet the Alaska state standards. The Anchorage School District provided all elementary teachers with laptop computers. The study involved interviewing six graduates and found that many preservice teachers lacked the technology skills as well as their mentor teachers. When asked if the laptop help prepare them as teachers, only two indicated that it was important, while three did not find their preservice laptop helpful in their technology use as teachers. The study was ongoing but no follow up studies were found.

McKimmy and Leong (2005), in their study of the laptop program in the College of Education at the University of Hawaii Manoa, found that the hardware and software infrastructure supporting technology-integrated software was difficult to maintain. Their Technology Skills Inventory assessed the preservice teachers and found that they self reported higher basic and personal/professional skills but were unable to draw conclusions of the preservice teachers' ability to integrate ICT in their teaching.

#### 2.3.4.5 University of Strathclyde

At the University of Strathclyde in Glasgow, Thornbury, Law and Henderson (2003) completed a case study on their ubiquitous laptop program. The administration visited many American laptop universities and started with a pilot in 2000 with one faculty and 354 students in a business course. The article describes the history of the implementation of the laptop program and recommendations for success. The program now extends to the whole university, including their Faculty of Education but does not give specific details as such. This was included to indicate that the global increase in laptop educational institutions is not just a North American phenomena. A visit to the

University of Strathclyde website in June, 2008, indicates students now have a choice of laptops to bring to class with minimum specifications.

#### 2.3.4.6 Nipissing University

Nipissing University's Faculty of Education was the first in Ontario and second in Canada to implement a ubiquitous laptop program. The introduction of the program started with a pilot project of one Junior/Intermediate section of 40 B.Ed. preservice teachers who were given a laptop to use throughout the 2001-2002 year. In the following year, the entire Junior/Intermediate division had laptops and the Primary/Junior division had one section as a pilot project. This same implementation process continued with the Intermediate/Senior division the following year and by the 2004-2005 year all faculty and preservice teachers had laptops. Stewart (2003) assessed the early implementation process and conducted semi-structured interviews of the Junior/Intermediate B.Ed. faculty at Nipissing University during the 2001-2002 year. The analysis of the interviews was framed around six themes of program implementation: vision building, evolutionary planning, empowerment and initiative-taking, resources and assistance mobilization, problem coping, and restructuring. Initial faculty development included workshops which were not well attended by faculty but they did receive some one to one assistance (Stewart, 2003).

Stewart (2003) states that there was a wide range of computer experience varying from extensive to very limited with the initial faculty. He states that all faculty interviewed had taken steps to advance their own use and proficiency with computers and many had paid to take computer workshops, courses and one on one training. Some of the concerns of faculty at that time included lack of professional development opportunities, technical difficulties, lack of time, and lack of vision for the laptop program.

Kariuki and Weeks (2003) surveyed 40 preservice teachers in the pilot program at Nipissing University and these statements by preservice teachers indicate faculty were not modeling the integration of ICT into their teaching. The faculty required more training on software and synchronous communication was an off task behavior problem with preservice teachers in the academic classroom.

When the preservice teachers were asked the advantages of the laptop over the use of the desktop computer, they indicated that, they preferred the access to computer

due to portability, the ready access to research/information, the ease of assignment completion, the access to Ontario educational software, the ease of email communication with friends and faculty, the ease of developing lesson plans and ability to collaborate in group work (Kariuki & Weeks, 2003).

The preservice teachers indicated that they wanted to learn how to use the software in the laptops as little or no time was devoted to teaching how to use the software. The preservice teachers wanted Internet access while practice teaching as well as access to data projectors in the school classrooms. There was little evidence that the laptops were used for in class teaching/learning activities, indicating that there was a lack of modeling by associate teachers and/ or lack of ICT support infrastructure. Most preservice teachers indicated an increase level of confidence in using ICT as a result of have constant access to laptops (Kariuki & Weeks, 2003).

Weeks (2004) surveyed 300 Nipissing University preservice teachers in March 2003 to determine their use of the laptop and technology in their practicum. When preservice teachers were asked which areas had been a source of learning about computers and educational applications, the highest ranking was self, at 8.4 out of 10 while the lowest was the associate teacher at 1.8. While on the practicum, 10 % did not use their laptop at all, 30% used it sometimes, 33% used it most of the time and 27 % used it all the time. On a scale of 3-0 the highest use level (2.7) was for lesson preparation and the lowest level was for lesson delivery and communicating with the associate teacher (both at 0.5). Over half, 54% of the preservice teachers stated the schools that they had their field placements in were poorly equipped in terms of computers and peripherals. Only 7% indicated that the school was well equipped with ICT. Weeks (2003) concluded that the associate teacher was not a source of ICT learning for the preservice teacher and that the schools lacked ICT resources to support the preservice teacher in integrating ICT into their teaching. The lack of authentic classroom experiences in using ICT is a concern. The fact that the preservice teachers use their laptops most or all of the time demonstrates their desire to use ICT as well as the appreciation of its utility.

#### 2.3.4.7 University of Ontario Institute of Technology

Kay (2004) describes the effective use of laptops at University of Ontario Institute of Technology, which includes a Faculty of Education. He mentions that many faculty members only use ICT for PowerPoint presentations, web pages and email but there are more potential teaching strategies to be used to enhance learning. Many of the activities were based on well grounded learning theories including cooperative learning, constructivism, facilitation and coaching, problem based learning, higher level thinking skills, incorporating a variety of learning styles, connecting concepts to real world knowledge and actively applying knowledge (Kay 2004; Kay & Knaack, 2005).

Some of the activities that the students engage in during class with the laptop include: debates using online discussion boards, case studies, webquests, researching, online questionnaires/ inventories, java applets, streamed videos, posting key questions at the end of class, previewing assignments and giving immediate feedback, and web knowledge. Student activities outside the class include; online discussion for building knowledge, post and evaluation of solutions in discussion board, communication with peers and professors, streamed videos, demonstration of specific tasks, creating E-portfolios, video projects, resource collections, and group work (Kay 2004).

Faculty members have laptops and the activities that can be done in class include: PowerPoint presentations, polling students, and quick content questionnaires. Kay (2004) mentions that it is important to have the preservice teachers put their laptops down during a lecture because many engage in off task activities such as surfing the web. Faculty activities outside of class include: web pages, which include lesson plans, resources and assignments, and monitoring and participating in discussion boards (Kay 2004).

An assessment of the attitudes of the 52 preservice teachers found that there was a significant ($p<.005$) gain in self efficacy and intentions to use computers in the future, but not in the affective or cognitive attitudes. In the assessment of computer skills, preservice teachers improved significantly ($p<.001$) with respect to operating system, communication, Internet skills, word processing, spreadsheet, database, graphics, multimedia, web page creation and programming skills. The preservice teachers used the laptops at the university and in the practicum field placements for planning lessons, using application tools in class and for group work (Kay 2004).

Kay and Knaack (2005), in their study of computer attitudes, ability and use of preservice teachers in an Ontario ubiquitous laptop teacher preparation program, found significant differences in behavioural attitudes, self efficacy but not in affective and cognitive attitudes. With the ubiquitous laptop, the preservice teachers improved in 10 computer ability areas: operating systems, communication, World Wide Web, word processing, spreadsheets, database, graphics multimedia, web page design, and programming.

Kay (2008) surveyed 168 preservice teachers in a laptop program at the University of Ontario Institute of Technology on their emotions before and after the 8 month program. It was found that anger and anxiety levels decrease significantly while computer knowledge increased. There was an increase in happiness and a decrease in anxiety with an increase in seven to eight computer skills. Recognizing a link between emotion and cognition makes further research in this area a consideration (Kay, 2008).

vanOostveen, Hunter, Kay, and Muirhead (2007) completed a study on the development of argumentation skills in high school science students using videos of classroom settings. Some of the videos include teacher demonstrations, class hands on activities, and classroom discussion. The videos included interviews with teacher and student about the activities. The videos case documentaries were stored in a web environment and viewed by preservice science teachers. All interactions of the preservice teachers during the viewing were recorded using Camtasia Studio, a software package that allows screen capture of video recordings as well as audio recordings of student conversations and mouse movements. Students were asked to prepare reflections of the case study and post them to an electronic bulletin board. The study was not focused on the laptop but rather the teaching strategies, specifically teaching argumentation skills in a science class, that were made available using ICT with a laptop. The preservice teachers enjoyed watching the video clips and found the project useful. It was a way to enter the classroom in a non-invasive manner using ICT.

### 2.3.5 Comparison of award winning Faculties of Education

Hofer (2003) compared seven ISTE NETS Distinguished Achievement Award winning teacher education programs for exemplary implementation of the ISTE NETS standards. Of these US institutions, two were ubiquitous laptop universities, Valley City

State University and Wake Forest University. The multi method study consisted of an analysis of the documentation that each university submitted for the consideration of the ISTE NETS Distinguished Achievement Award, related course syllabi, 17 completed instructor questionnaires and interviews. It should be noted that Hofer teaches humanities in the Introduction to Educational Technology and assisted in the submission of the ISTE NETS award application at the University of Virginia, one of the seven universities studied and not a laptop university. Each of the seven universities' program coordinators who submitted the award application were interviewed by phone. Documentation included website analysis, information on technology integrated courses, a matrix demonstrating implementation of the ISTE standards and student work samples as evidence of achievement of the standards. A matrix was created indicating the different types of courses and how they addressed each standard. All universities' courses percentages were averaged together, and it was found that in addressing the standards, their technology courses met 83%, the methods courses met 70%, the education courses met 36 % and the field experience met 70%. Five of the seven teacher education programs required at least one educational technology course and two of the universities offered three and four technology courses. The study did not indicate the length of the education programs but a review of Wake Forest web page in June, 2008, indicates a two year program (Hofer, 2003).

Some of the findings coming out of the comparison of the seven Faculties of Education document that a combination of courses were used to integrate the ISTE standards, a stand alone technology course, methods courses, educational courses and field experiences. The technology course did not focus on technology itself but on teaching and how it can complement and support other courses. The institutional support is important in the implementation of the standards. Hofer (2003) recognized that each university had its own culture and a recipe that works at one university could not simply be transferred to another setting.

### 2.4 Faculty development in the teaching of ICT

Most studies indicate that educators require more faculty development and time to learn how to use the technology (Stewart, 2002; Weeks & Kariuki, 2003; Lim, 1999; Wicker & Boyd, 2003; Resta et al., 2004; Scott, 2005; Bin-Taleb, 2005; Thompson et al.

2003). Effective professional development must precede the introduction of ubiquitous computing. Teachers and their students benefit from the teacher's mastery of ICT skills prior to teaching with technology (UNESCO, 2002).

Faculties of Education are on the front line in teacher preparation and they must have faculty who have the knowledge of technological skills and be able to model the ICT skills when teaching in a laptop environment (Krueger, Boboc, Smaldino, Cornish, & Callahan, 2004). As laptop environments are recent and not familiar to all, faculty are having to learn the ICT skills to teach preservice teachers, and one method of learning is through effective faculty development (Brown, 2000).

Effective faculty development is crucial to educating teacher educators. "In order to prepare tomorrow's teachers as technology-using teachers, faculty development is the critical enabler. Through increased training, access, support and incentives, faculty members became confident users who recognized the potential of technology to change and improve learning." (Judge & O'Bannon, 2008, p. 26).

### 2.4.1 Professional development in schools

Penuel (2006), in a synthesis of studies on one-to-one computing in K-12 schools, found that the amount and form of professional development shaped the outcome of the teacher's professional development experience. Some of the teacher professional development experiences include workshops, assistance with content specialists, staff to assist on an 'as need basis', and informal help from colleagues within the school. Similar experiences for success can be considered in a university setting and where frequency and types of faculty development can be considered. Faculty and administrators can learn from their colleagues in the field.

#### 2.4.1.1 Faculty development in teacher education

Part of the success in having preservice teachers learn about ICT integration depends upon the faculty developing the skills, knowledge, experience and attitude to teach and model the integration of ICT into teaching. Ellis (2004), the instructional service director of a small, rural, Midwestern liberal-arts university in a Faculty of Education, completed a study on faculty development to help preservice educators model the integration of technology in the classroom. The investigation was a participatory action research study completed over a sixteen week semester with the purpose to get

faculty to model the integration of technology into their teaching. The number of faculty or students, or the size of classes is not discussed. There is no mention of a teaching practicum or if this was a laptop university. The research was qualitative and has no statistical information. His conclusions indicate that the action research method embraced by the faculty worked positively for faculty development in ICT integration.

Ellis (2004) found that small workshops and brown bag sessions were poorly attended. He started having faculty meet in groups of two for training which worked well compared to one on one. This created a collaborative environment for the faculty with someone else to work with prior to the weekly meetings with Ellis. There was mixed success with the regular larger bi-weekly team meetings, called a learning community, where it was difficult to schedule all people together. Ellis found that the larger group meetings were not productive but faculty stated it was nice to socialize with some of the other faculty.

Change theory was used to analyze the data in the study and how the Faculty of Education professors dealt with the change of integrating instructional technology into their own teaching methods. He also discusses some of the changes that he had to adopt in a new way of teaching. The method of teaching suggested is lecturing with technology, including use of video, the Internet and PowerPoint presentations. One of the practical suggestions to assist faculty was to set up simple, easy to follow, one page instructions with an abbreviated flow chart on the back to aid the faculty in remembering certain functions in software application. These instructions were also set up as Internet pages (Ellis, 2004).

The professors were concerned that in class, students were off task often, because of the technology, such as email. Time was wasted when the technology failed to work. One professor did not want to look like an ‘idiot’ when he could not get something to work. One professor stated that unless the technology exists to specifically assist him in his subject area, he does not want to waste time learning about it (Ellis, 2004). In reference to Howard Gardner’s theory of multiple intelligences, Ellis suggests that technology may be another type of intelligence as some people are very natural with it while others seem to flounder and give up (Ellis, 2004).

Bell and Ireh (2002) reported on a study completed at Winston-Salem State University's teacher education program where professional development of faculty in the use of curriculum alignment, computer skills and multimedia technology improved their program. Evaluations suggest that the teachers found the workshops useful, student improvement was enhanced and teachers felt more competent in curriculum design, assessment and computer utilization. The study does indicate the university received funds from a PT3 grant, Technology Infusion Project but does not state how or how long the workshops were run.

### 2.4.2 Barriers in adopting technology

UNESCO (2002) provides the framework for establishing ICT into education but this is a slow process filled with many barriers. Pan (2000) states five of the obstacles Faculties of Education have had in infusing technology into their programs 1) lack of financial resources to support ICT, 2) faculty being out of touch with the reality of the school, 3) inadequate faculty development and time allocation to support ICT in teacher education courses, 4) strong resistance from some faculty to adopt ICT into their teaching and/or are reluctant to participate, and 5) a lack of plans excluding preservice and inservice teachers, students and the local community (Pan, 2000).

Steps were taken at the School of Education at the College of New Jersey to restructure the teacher education program with computer technology integration. There are no details of the size of the college, the number of faculty involved, if it was a ubiquitous laptop program or the amount of instructional hours in the computer course. The plan involved using faculty development to educate a group of preservice teachers to become technology experts and become the task force in shifting the focus on technology from the faculty to the preservice teachers. The plan involved having: a) preservice teachers' peer mentoring and support system, b) cooperation and collaboration between preservice teachers, faculty, ICT team, teachers, community and industry, and c) computer course revision (Pan, 2000). The importance of faculty development and a plan to involve others in the goal of integrating ICT are transferable concepts to a ubiquitous environment.

A faculty survey found that the teacher education faculty needed help with ICT and wanted specific examples of integrating ICT into the curriculum. In a preservice

teacher survey, computers were used for mainly, surfing the web, email and typing papers. Many preservice teachers lacked skills and knowledge of ICT integration into the curriculum. Visits to the classrooms where preservice teachers were practice teaching yielded anecdotal evidence that only a minimum of ICT integration was occurring in the regular classroom and that the preservice teachers did not have opportunity to use computers in their teaching (Pan, 2000).

A few suggestions were made by Pan (2000) in addressing some of the issues such as preservice teachers taking a basic computer literacy course where they learn about different applications, create web pages and create multimedia presentations. He also suggested integrating technology into each of the courses. The concern of simply requiring professors to integrate ICT and assigning technology based tasks may cause problems if the preservice teachers do not have the skills to complete the tasks, such as web page creation.

Faculty had resistance to technology integration due to the amount of time and effort required to learn the technology. There is a lack of incentives to motivate faculty to participate in ICT integration. There was inadequate ICT technical support, training and lack of resources. When preservice teachers from the computer literacy class worked with faculty, the faculty learned about the convenience and importance of web pages as well as PowerPoint presentations. Follow up literature on this project was not found in an electronic search (Pan, 2000).

Additional and similar barriers were found by Rogers, (1999) who examined barriers to technology adoption based on a search of the literature and the results of two studies, K-12 teachers and higher education faculty in the United States. A meta-analysis of the literature addressed ten barrier category items including: 1) availability and quality of hardware/software, 2) faculty role models, 3) funding, 4) institutional support, 5) models for using technology in instruction, 6) staff development, 7) student learning, 8) teacher attitudes, 9) technical support, and 10) time to learn to use the technology (Rogers, 1999).

The barriers to ICT adoption are a combination of many factors. Rogers (1999) classifies the barriers of successful technology adoption into two main categories: internal and external. Internal barriers can be combined together as teacher attitude and

perception towards technology. External barriers are categorized into three areas, availability and accessibility, technical and institutional support, and stakeholder development. There appears to be a strong interaction and interdependence among the three external barrier categories. The barriers that cross internal and external sources are lack of time and funding (Rogers, 1999). He makes several recommendations in technology planning to avoid some of the barriers: 1) determine the goals of teaching and learning first, 2) assess the technology adoption of the stakeholders, particularly the faculty and staff, 3) assess the attitudes of the stakeholders toward technology in education, 4) consider the three barriers to technology adoption, availability and accessibility, technical and institutional support and stakeholder development simultaneously, and 5) technology plans must include a consideration of time and funding issues.

#### 2.4.2.1 Faculty development and overcoming barriers

In studying technology professional development in K-8 schools, Brinkerhoff (2006) examined why technology was not being effectively integrated into the classroom. He found that barriers, any factor inhibiting ICT integration by teachers, can be grouped into four main categories: resources, institutional and administrative support, training and experience, and attitudinal or personality factors. He states that resources are most important as it influences the institutional support while training and attitudinal factors can be addressed with faculty development (Brinkerhoff, 2006).

Bohannon (2001) states that Florida Gulf Coast University (FGCU) in 1997 made its mission statement to include the integration of instructional technology and established an Office of Instructional Technology, a faculty support system. The infrastructure was expanded to include Technology User Support, Multimedia Design Services and Course and Faculty Development services. Faculty development at FGCU must be supported by the institution. This means faculty members participate in a wide range of faculty development strategies as well as overcoming barriers that may exist. Some of the traditional faculty development activities include skill development workshops, presentations by outside experts, and discussion seminars. Also listed are individual consultations to solve problems, collaboration with instructional design team

to redesign a course, participation in formative peer coaching, and taking a self paced software tutorial online (Bohannon, 2001).

The first barrier that FGCU encountered was ensuring the technology is ready and working for each classroom and if it isn't working, a quick phone call to tech support would fix the problem. The second barrier was the need for faculty to master many specialized skill sets including knowledge of current instructional technology, application of instructional design theories, programming, multimedia development techniques, graphic design and web development. Faculty had to be subject matter experts as well as produce technology-enhanced courses where they are the independent managers of those courses in the process (Bohannon, 2001).

The third barrier was being new to the campus. Anyone new to teaching at FGCU now had to master a long list of digital tools to be competent in teaching with ICT. These new faculty required support of the appropriate services on the campus (Bohannon, 2001).

The fourth barrier to the use of ICT was the problem of limited time, schedule inflexibility and learning style preference. Ten strategies were developed to provide faculty development support and these were divided into three categories, 1) group strategies- skill development workshops, topic centered study groups, faculty led sharing seminars, 2) individualized strategies- course development teams, instructional design consultations, house calls, peer coaching and 3) web based strategies – online tutorials, online faculty orientation and user group facilitation (Bohannon, 2001).

Bohannon, (2001) describes the success that has occurred in the three year period from 1997 to 2000. A faculty survey indicated that one hundred percent of the faculty use the Internet as a resource to teach, research, and email for instructional communication. Ninety-three percent created classroom materials with presentation software and eighty-five percent used electronic databases that are part of the library. More than fifty percent used synchronous collaboration tools to post and discuss assignments with students and utilized a course website. Student surveys indicated that eighty-five percent felt that ICT contributed to learning and that ninety-two percent agreed that adequate technology was available to support teaching and learning. Bohannon concluded that technology has

become part of their way of life and learning to harness its power required vision and endurance (Bohannon, 2001).

### 2.4.3 Models of faculty development

Judge and O'Bannon (2008) studied a development model in the faculty integration of technology into teacher preparation at the University of Tennessee, in Knoxville. They found that a variety of approaches and strategies were used to assist faculty in restructuring their curricula and to learn how to effectively model ICT integration. The model was funded by the Preparing Tomorrow's Teachers to Use Technology and was called Implementing Partnerships Across the Curriculum with Technology Project (Project ImPACT) which was founded on the ten essential conditions (ISTE, 2002). There was emphasis on access, training, support, incentives and evaluation. A full time coordinator and three graduate assistants were hired to support the project (Judge & O'Bannon, 2008). Although this was not a laptop Faculty of Education, there were some approaches that are worth considering such as the incentives. Although modeling by faculty is used, if preservice teachers do not have laptops, the question of how they will learn to use the technology arises (Judge & O'Bannon, 2008).

Each faculty member participating was given a laptop to have access to current technologies, software and technology equipped classrooms. Additional resources included two computer labs equipped with 15 computers, a SMART board, a document camera, still and video cameras, scanners and software. Assistive technology was also made available as well as three multimedia labs (Judge & O'Bannon, 2008). The class size of 15 for computers was ideal and it would be hoped that teachers in the field would have the same environment.

The faculty chose from a variety of training methods including, bi-weekly Brown Bag Lunch Technology Awareness presentations, formal workshops and individual training in offices or classrooms. Half-day workshops were also offered on various technology topics. Faculty members were also given the opportunity to train with a mentor (Judge & O'Bannon, 2008). It does not mention how well the presentations were attended by faculty or if they had to attend. There was a survey for the faculty afterwards indicating that they found various parts of the project useful, including high utility in support for technical staff, workshops and incentive grants. One component that is

missing from the project and which occurs often with such faculty initiatives, is the evaluation of faculty to see if learning has occurred (Guskey, 2000).

A variety of team configurations were created for support. Five teacher education faculty members were members of the Project ImPACT team serving as advisors in issues in the field and working with other faculty in integrating technology into their courses. Faculty intern supervisors were members of learning teams in partner schools and assisted in developing technology-enhanced lesson plans. Faculty encouraged interns to develop required action research projects that focused on technology issues (Judge & O'Bannon, 2008). The integration of ICT into field placements and the partnerships with schools are excellent methods of authentic learning; however, the study does not state if the schools were equipped with ICT technologies.

There is a considerable amount of time invested by faculty in learning, developing, and implementing courses during the process of integration of ICT into teaching. Incentives can encourage faculty to invest the time to learn how to infuse ICT into teaching. Mini grants were offered to faculty to cover the time required to design and implement their modified course. To qualify to receive a mini grant faculty had to submit a proposal describing how they would revise their courses to effectively integrate ICT into student learning activities. As well each revision had to address the NETS for teachers, standards established by ISTE. Secondly, faculty members were also eligible for up to US$10,000 for equipment, software, training opportunities and/or graduate assistance. The third incentive was availability of travel funds to faculty who had a paper accepted at a major conference to disseminate information about their course modification (Judge & O'Bannon, 2008).

Judge and O'Bannon (2008) found that there were five main themes within their data collected from the faculty survey: 1) perceived relevancy of technology applications, 2) faculty commitment and prioritization; 3) time needed to develop and use technology skills 4) incentives; and 5) access to resources (Judge & O'Bannon, 2008). Faculty development opportunities focused on ICT skill acquisition, effective use and modeling of technology, developing technology rich assignments for their courses and instructional design and integration strategies (Judge & O'Bannon, 2008).

The three major recommendations that Judge and O'Bannon (2008) make are: 1) the availability of technology enhanced classrooms are limited and faculty must have access to advanced technologies, 2) creating an incentive system to encourage all faculty to integrate technology, and 3) a community of practice should be developed. The new teacher education faculty members being hired are confident with the technology and integrating it into their teaching. The senior faculty members rarely see the need to use the technology. The barriers include insufficient time to develop technology based work and insufficient reward/incentive. There is no link between technology integration and tenure, promotion or merit pay. Project incentives, including stipends, equipment, graduate assistance and travel contributed to the integration of ICT into teacher education courses. A community of practice would include groups of faculty members that would be able to learn from each other, meet regularly to share ideas, learn from others helps promote a culture of technology-enhanced teaching and learning in the college (Judge & O'Bannon, 2008).

#### 2.4.3.1 UNESCO Model of ICT integration into teaching

Faculty development is one of the cornerstones in the UNESCO (2002) document *Information and Communication Technologies in Teacher Education: A Planning Guide* (2002) for teacher educators. In the forward it states:

> Teacher education institutions may either assume a leadership role in the transformation of education or be left behind in the swirl of rapid technological change. For education to reap the full benefits of ICTs in learning, it is essential that pre- and in-service teachers are able to effectively use these new tools for learning. Teacher education institutions and programmes must provide the leadership for pre- and in-service teachers and model the new pedagogies and tools for learning. UNESCO (2002, p.1)

The UNESCO planning guide is a comprehensive well planned document and makes recommendations on the many aspects of implementing the integration of technology, ICT, into the classroom through teachers, teacher development, administrators, school boards, teacher education facilities and larger organizations which would include provinces and countries. It provides a theoretical background, a rationale and framework, curriculum development and standards (ISTE NETS, 2004), essential components, to support ICT in teacher development, suggestions on professional development,

developing a strategic plan, managing this innovation and change and some suggested strategies with sessions and examples (UNESCO, 2002).

Within the UNESCO (2002) document, there is an extensive chapter on the preservice teacher education preparation for ICT. Four themes are identified and competencies described on how to plan to integrate ICT's within teacher education programs. Collaboration is suggested among professional associations, countries, states or universities with the larger educational community.

Below, in Figure 1 is a model and description of the framework for ICT's in Teacher Education from the UNESCO document. The model contains four themes, context and culture, leadership and vision, lifelong learning, and planning and management of change. The brief descriptions of the competencies follow the diagram.

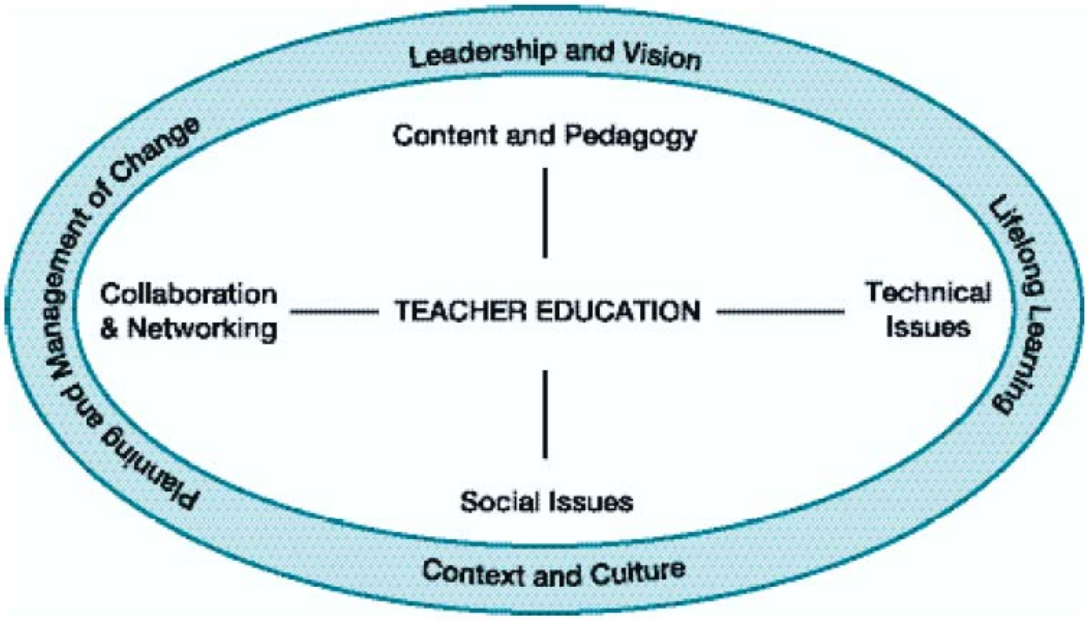


Figure 1: UNESCO Model of ICT in Teacher Education: A model framework for ICTs in Teacher Education (UNESCO, 2002, p. 41)

> Four Competencies
> The ICT competencies are organized into four groups. *Pedagogy* is focused on teachers' instructional practices and knowledge of the curriculum and requires that they develop applications within their disciplines that make effective use of ICTs to support and extend teaching and learning. *Collaboration and Networking* acknowledges that the communicative potential of ICTs to extend learning

> beyond the classroom walls and the implications for teachers development of new knowledge and skills. Technology brings with it new rights and responsibilities, including equitable access to technology resources, care for individual health, and respect for intellectual property included within the *Social Issues* aspect of ICT competence. Finally, *Technical Issues* is an aspect of the Lifelong Learning theme through which teachers update skills with hardware and software as new generations of technology emerge. (UNESCO, 2002, p. 41)

The report describes how different countries have supported ICT in education and describes the process in England, United States, South Africa, and Chile (UNESCO, 2002). As of 2008, Canada is not among the countries to adopt this policy.

The plan is quite methodical in its approach to ensuring the integration of technology. Below is an outline of the planning process and it deals specifically with faculty development as an integral part of the plan with the support and development of all of the components of the system. This plan reinforces the concept that faculty development is not an isolated event, but must involve planning and support with people from all levels of different systems including the government, the universities, the professional associations to set standards, as well as the schools.

> *Organizational Phase:* The Technology Planning Team is formed with representatives from key stakeholder groups. The scope of work is determined and the planning tasks to be accomplished are identified.
>
> *Assessment and Analysis Phase:* An analysis is made of the present situation including the present level of technology knowledge and skills of teacher educators, the teacher education curriculum and performance results, national teacher technology standards, condition of teacher education facilities, and the current technology resources and infrastructure within teacher education programmes or institutions. A powerful vision for ICTs in teacher education is developed focused on improving teaching and learning. Specific goals and objectives are developed to achieve the vision.
>
> *Formulation Phase:* Based on the vision, goals and objectives, a technology plan is developed including standards and models for technology and learning, hardware and software requirements, staff development plans, technology support services to be provided, facility improvement requirements, project timelines, areas of responsibility, and a detailed budget. These items are integrated into a comprehensive technology plan that is submitted for review and approval. (UNESCO 2002, p. 116)

UNESCO with the support of many countries, including the United States, has a comprehensive policy and plan on the integration of technology into teaching and teacher education programs.

A five step model of adoption of technology model developed by Reiber and Welliver (1989), and Hooper and Reiber (1995) (as cited in Rogers, 1999) describes the stages associated with infusing a new technology in teaching and learning. The stages of adoption are: 1) familiarization, exposure to the technology, 2) utilization, trying the technology, 3) integration, beginning to use the technology for appropriate use, 4) reorientation, reconsidering and reconceptualizing the purpose and function of the classroom and 5) evolution, the continued ability to grow and change as the needs of the learner and the learning context change. The people who ranked themselves at the higher adoption level had less barriers (Rogers, 1999). People who adopted ICT the quickest were problem solvers.

### 2.4.4 Lessons learned from ubiquitous laptop universities

Brown (2000) writing about 75 professors who tell their stories in teaching with technology, suggests eleven successful common practices for faculty development. These lessons were not specific to Faculties of Education but more to administrators in higher education: 1) Faculty should start from course objectives, not technology. New technological tools (PowerPoint, web pages, listservs) can be considered in designing a course. 2) Consider nontechnological solutions as people should not be blind advocates for technology. 3) Just in time instruction is helpful to both students and faculty. 4) Recognize disciplinary and student constituency differences as specialist will help with unique challenges. 5) Recognize the lowest common denominator of student success. Some people may have slow modems so avoid web pages with slow loading graphics. 6) Use development teams and encourage collaboration. It requires a lot of time to know subject matter, pedagogy, and technology as well as research and teaching. 7) Support both online and face to face courses. 8) Identify a preferred course management system and use it throughout. 9) Provide computer labs and studio classrooms for high end users. 10) Gain advice and direction from faculty. And 11) assure the individual, when-needed access to the five talents, who are faculty mentors, technologists, learning tools specialists, instructional designers and grunt workers (Brown, 2000).

Brown (2000) also suggests programs and strategies for faculty development including help desks, a wide variety of courses, classes and seminars for faculty depending on need, individual consultation, faculty grant programs for release time to

incorporate technology into teaching, standardization such as course management systems, email systems, student assistance to supplement staff and help professors and course designers.

The teacher education faculty at Brigham Young University chose to participate in the same course that the preservice teachers were taking including the assignments, modeling the assignments in preservice courses, and creating assignments where the ICT skills learned could be used. Some assignment modification was done after some faculty members were going to drop out. Only 61% of the faculty completed the course and 25-30 % completed assignments on time. Focus groups and interviews found that most faculty members benefited from the experience (Roque & Popham, 2002). It did not specify if this was a laptop program nor did it mention if the faculty members were in the same classes as the preservice teachers. The completion of a course by faculty that is required by the preservice teachers is a novel and effective method of faculty development. However, this could cause some professionalism concerns as some faculty may feel awkward if they were in the same class as their students.

Harvey – Beavis (2003) in a meta-analysis of published literature on performance based rewards for teachers describes three main models of performance based reward programs; 1) merit pay, where an individual receives a reward based on student performance and classroom observation, 2) knowledge and skill-based compensation, for acquiring qualifications and demonstrating knowledge and skill which are believed to increase student performance, and 3) a group based compensation, based on student performance. There have been many performance based systems tried regarding advantages and disadvantages but these will not be discussed at length. The present system of salary compensation in many Faculties of Education involves an increase in pay as experience increases. This present salary system does not recognize the time required to learn new skills in ICT integration. Financial reward is one method of motivating faculty but it does not work with all faculty members where many are motivated intrinsically through satisfaction from high student achievement, recognition, influence, learning new skills and personal growth (Harvey-Beavis, 2003).

#### 2.4.4.1 Faculty development strategies

Brown, Burg, and Dominick (1998), in their description of a strategic plan for ubiquitous laptop computing at Wake Forest University and Acadia University in 1996 (Tomek & Mulder, 1999), give several suggestions on how to set up a university for one to one computing. Both Wake Forest University located in North Carolina and Acadia University, situated in Nova Scotia, implemented the laptop program university wide, including their Faculties of Education. The Wake Forest degree is a three year program while the Acadian experience is a two year program.

One of the goals stated at Wake Forest is to have educators communicate effectively with students, which includes speaking the language of a computer-nurtured generation. The two prong strategy of standardization of platforms and decentralization of implementation has made this initiative a success. The faculty development strategies included:

> 1) Academic Computer Specialists (ACS) who are staff members working directly within departments to help faculty with computers in instruction,
>
> 2) Student Technical Advisors, (STARS) students who work in partnership with individual faculty members to implement specific ideas for computer-enhanced instruction,
>
> 3) Computer-Enhanced Learning Initiative (CELI), a group of faculty who help identify, develop, and disseminate ideas about computer-assisted learning and
>
> 4) The Hope Initiative, a faculty based initiative for development of distance-learning environments and avant garde research into computer-enhanced instruction. (Brown et al., 1998, p. 5)

The faculty development does not stand alone and is serviced and supported with four major support groups: 1) Training is available via online software and regularly scheduled training classes coordinated with the library; 2) There is a help desk that answers technical questions, handling computer repairs and provides loaner equipment; 3) There are 20 student resident technology advisors (RTAs) that provide support for students in residence; and 4) There are 14 Academic Computer Specialists (ACSs) hired by department chairs to assist faculty in the integration of computer use.

The goal of the faculty in the Computer-Enhanced Learning Initiative (CELI) is to reach late adopters and have them reconsider their course material and presentation. CELI arranges trips to workshops, sponsors faculty release time, coordinates swap and

share discussion groups, searches out computer based teaching strategies by reviewing the literature and presenting ideas and innovations to the outside world on web pages and through an online interactive journal. The student technical advisors (STARS) are paired with faculty members who require assistance in incorporating ICT into their teaching. The STAR is the technology expert and the faculty member is the subject expert.

The CELI project was funded by an anonymous donor who provided the opportunity for faculty to apply for course release time grants to research and design computer enhanced learning materials for their class and present these innovative projects in a public forum in luncheon meetings. There was some difficulty in finding adjunct faculty to cover these courses and although they had a course release they were still required to participate in administrative functions such as committee work. The projects were stored on a website (Wicker & Boyd, 2003).

Additional funding to establish a summer program for technology adoption came from a three year grant from the Charles E. Culpeper Foundation. These $2900 grants were open to a maximum of twelve faculty members to work in the summer to develop teaching strategies incorporating technology and included $1200 for the purchasing of software or computer accessories. At the conclusion of the summer, the recipients were required to write a report to the Dean and complete a poster presentation at a technology fair. The Culpeper grants were more receptive by faculty than the CELI possibly because they were offered in the summertime and did not conflict with regular teaching time (Wicker & Boyd, 2003).

Internal surveys of faculty at WFU indicate that the number of faculty that never used technology in any aspect of their teaching decreased from 35% in 1995 to 3% in 2001. There was also an increase in the number of computers used in classroom presentations from 45% in 1996 to 80% in 2001 (Wicker & Boyd, 2003).

## 2.5 Introduction of diffusion of innovation theory

An overview of diffusion of innovations theory (Rogers, 2003) follows that includes: the elements of diffusion, the innovation-decision making process, the importance of communication channels (Frank, Zhao, & Borman, 2004), the innovation decision making period, the attributes of innovations and rates of adoption, determining innovativeness and identifying the adopter categories, the importance of diffusion

networks, the influence of the change agent, the innovation process within organizations (Yang & Patterson, 2005), and the consequences of innovations. Diffusion of innovation theory has been used as a conceptual framework for other research in technology in education (Shea, Pickett & Li, 2005) and has been a foundation for other change theory models (Ely, 1999; Ellesworth, 2000; Hall & Hord, 2006). Diffusion theory has been used within educational research (Rogers, 2003) to better understand the large number of innovations within the teaching profession (Lathem, 1988; Cogan, 2001). Within the discipline of information technology and teacher education, Willis, Thompson and Sadera (1999) reviewed the literature and identified a need for more research related to diffusion of innovation case studies. There have been models of teacher renewal based on diffusion theory (Thompson, Schmidt & Davis, 2003). Rogers' (2003) diffusion of innovation theory is not widely referenced within the body of literature of ubiquitous computing in Faculties of Education except for Rader (2005) in her study of foreign language preservice teachers experiences.

### 2.5.1 Elements of diffusion

Diffusion can be defined as the "process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 2003, p. 5). The elements of diffusion process can be divided into four stages. The process starts first with an innovation defined as anything perceived as a new idea, such as technology, by the individual. The second element is the communication channel, namely the diffusion of the idea from one individual to another. The third element in the process is time, which includes: 1) how much time is involved from the when the individual knows about the innovation to when either adoption or rejection occurs, 2) when the individual adopts the innovation compared to others within the social system, and 3) the rate of adoption within the system. The fourth element is the social system, the population of individuals collectively involved in a problem solving behavior. Within the social system there will be innovations adopted by individuals, or by groups of individuals. Occasionally there is a group decision that forces acceptance of the innovation on all people within the social system (Rogers, 2003).

#### 2.5.1.1 Innovation-decision process

The innovation-decision making process consists of five stages 1) knowledge, when the individual learns of the innovation and how it works; 2) persuasion, when the individual forms a positive or negative attitude about the innovation, 3) decision, when the individual makes a choice to either adopt or reject the innovation, 4) implementation, when the individual uses the innovation and 5) confirmation, when the individual seeks reinforcement of the innovation-decision but may reverse the decision at this time (Rogers, 2003).

The characteristics of the early knowers of an innovation when compared to the late knowers include more formal education, higher social status, greater exposure to interpersonal channels of communication, greater social participation, and greater cosmopolitanism (Rogers, 2003). Re-invention of an innovation can occur when an adopter changes or modifies the original use of the innovation. Higher degrees of re-invention can lead to faster rates of adoption and also sustainability, the length of time the use of the innovation is continued. Discontinuance can occur when an innovation is replaced by a better innovation or the user is dissatisfied with its performance (Rogers, 2003).

### 2.5.2 Communication channels

Communication channels are how information is transmitted from the source to the receiver. The source is the individual or an institution that originates a message while the channel is the means by which a message gets from the source to the receiver. Communication channels can be mass media-based or interpersonal. The mass media can reach a large audience quickly, create knowledge, spread information, and change weakly held attitudes. However, the interpersonal communications channels can change strongly held attitudes by an individual. It provides a two-way exchange of information, where an individual can form or change a strongly held attitude and is important in persuading an individual to adopt a new idea. Rogers (2003) makes some generalizations about the innovation-decision making process, noting that cosmopolite channels are more important at the knowledge stage and localite channels are more important at the persuasion stage.

People who use communication channels are considered social capital within organizations. Frank, Zhao and Borman (2004) indicated that the diffusion of innovation model suggests people change perceptions of their value of an innovation through communication with others and their perceptions drive the implementation. They found that the informal access to expertise and responses to social pressure are manifestations of social capital. The study suggested that change agents should be aware of social capital processes related to the implementation of education innovations such as computer technology. They indicated that previous research on the diffusion of computers in schools has focused on three factors: 1) access to reliable hardware, software and technical support was important to implementation, 2) institutional factors such as leadership and scheduling affected teachers' use of computers, and 3) the characteristics of the teachers such as willingness and ability to use the technology.

Frank, Zhao and Borman (2004) found that there was less research on the social contexts, processes and support in the teachers' use of computers that affect the implementation process. Their study involved six elementary schools in three states that were attempting to implement computer related innovations, one of which was a ubiquitous laptop wireless school. Teachers from the schools were interviewed and a survey was created and sent to eight schools with an overall sample size of 230 teachers. The results indicated that the teachers used the computers for an average 196 purposes per year, demonstrating the complexity of the computer as a bundle of innovations. The teachers reported significant technical problems 25 to 50 percent of the time. The perceived social pressure to use the computer ($p < .01$) and access to expertise through help and talk ($p < .05$) was statistically significant.

Frank, Zhao and Borman (2004) identify social capital as a fixed resource and attempts to implement multiple innovations at the same time pit one against the other competing for time. In implementing an innovation they suspect that informal help and social pressure are more important in adoption when the technology is complex, such as new software or computer technology.

### 2.5.3 Innovative-decision making period

The length of time required for an individual or organization to either adopt or reject an innovation is considered the innovative-decision making period. This time frame

Rogers (2003) describes how the Internet is changing the nature of the innovation-decision making period as it has both the capability of communicating through mass media as well as interpersonal channels, such as email. The rate of adoption can be increased as an email message can send information at the same time and cost anywhere around the world.

### 2.5.4 Attributes of innovations and rate of adoption

The rate of adoption by the individuals in a social system is determined by the characteristics of the innovation. Rogers (2003) states that the five attributes of innovations include: 1) relative advantage, 2) compatibility, 3) complexity, 4) trialability, and 5) observability. These are integrated factors that have an important influence on the rate of adoption of an innovation. The relative advantage is the expected benefits compared to the costs of adoption and is one of the strongest predictors of an innovations rate of adoption. Also considered within this attribute include economic profitability, low cost, a decrease in comfort, social prestige, a saving of time and effort, and immediacy of reward. “Compatibility is the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters.” (Rogers, 2003, p. 240). “Complexity is the degree to which an innovation is perceived as relatively difficult to understand and to use.” (Rogers, 2003, p. 257). “Trialability is the degree to which an innovation can be experimented on a limited basis, … and observability is the degree to which the results of an innovation are visible to others.” (Rogers, 2003, p. 258).

### 2.5.5 Innovativeness and adopter categories

The degree of innovativeness of the individuals within the social system can be classified into five adopter categories: innovators, early adopters, early majority, late majority and laggards (Rogers, 1962). The individuals within each of the adopter categories can have similar characteristics based on socioeconomic status, personality

values, and communication behavior. For example, in general early innovators tend to have more years of formal education, a higher social status, and a highly connected interpersonal communication channels than late adopters. However, this is dependent upon the innovation itself, where someone could be an early adopter with one innovation and a laggard in another. Adopter distribution tends to follow an S shaped curve over time with a tendency for a normal distribution (Rogers, 2003).

### 2.5.6 Diffusion networks

Opinion leadership is the degree of influence an individual informally has on people's attitudes or behavior in the decision to adopt an innovation. They play an important part in diffusion networks. Homophily is the degree of how similar people are, who communicate within the same group and heterophily is the degree of how different they are in certain characteristics. Interpersonal communication is higher among groups that have people of similar characteristics and can sometimes act as an invisible barrier in the flow of innovations to different groups of people with higher socioeconomic status, more education, and greater technical expertise (Rogers, 2003).

### 2.5.7 Change Agencies

Change agents are people who have a clear mandate to change the behavior of others, usually encouraging people to adopt an innovation. A change agent often encounters two barriers in their pursuit of change: 1) social marginality, in that they often have social and technical superiority than the individual who they want to change which can cause communication difficulties, and 2) the problem of information overload, where the individuals in the system have an excess of communication that cannot be processed or utilized which can lead to less adoptive behavior. Successful change agents have identified seven roles in encouraging the process of adoption within a social system and include: 1) develop a need for change, 2) establish an information exchange relationship, 3) diagnose problems and sympathize with the individuals perspective, 4) create an intent to change the client motivating their interest in the innovation, 5) translate their intent into action by working with opinion leaders and interpersonal networks, 6) stabilize adoption and prevent discontinuance, and 7) to achieve a terminal relationship in that the individual becomes self reliant (Rogers, 2003). Change agencies have offered various kinds of incentives to speed up the rate of adoption. Incentives have been paid to

adopters, to people to persuade adopters, individuals, and to systems as a whole. Incentives can be either positive or negative, as well as monetary or non-monetary (Rogers, 1983).

### 2.5.8 Innovations in organizations

Diffusion of innovations is different within organizations as they are a group of individuals making collective decisions. Within organizations, Rogers (2003) identifies three main types of innovative decisions: 1) operational innovative decisions which are made by the individual, 2) collective innovative decisions which are made by a group consensus within a social system and 3) authority innovation-decisions which are made by a few individuals in a system who possess power, status, or technical expertise. Within a system, an individual's decision making process on whether to accept or reject the innovation, may be influenced by other individuals. When this is done informally, it is called opinion leadership. When there is an attempt to directly influence an individual in the decision making process toward a certain innovation, this person would be called a change agent (Rogers, 2003).

Description of the adoption of an innovation process in organizations includes the time before the decision to adopt, the initiation process, and afterwards, the implementation process. The whole innovation process is divided into five stages, of which the initiation process includes: 1) agenda setting, where organizational problems create a perceived need for an innovation, and 2) matching, where the organization's agenda is considered together with an innovation which involves planning to integrate the innovation (Rogers 1995). At this point in the process, the decision to adopt is made. Following this is the implementation process, divided into three stages: 3) redefining/ restructuring where the innovation is modified to fit the situation of the organization, which includes some alteration of the structures of the organization, 4) clarifying, where the relationship between the innovation and the organization is defined more clearly as the innovation is regularly used, and 5) routinizing, where the innovation loses its separate identity and is incorporated into the regular activities of the organization (Rogers, 1995).

Yang and Patterson (2005) explored technology diffusion from the perspective of organizational change. They recognized the multi-dimensional nature of technology

diffusion within teacher education and suggested a number of approaches to increase the chances of successful implementation for IT leaders. They derived a table of faulty assumptions and compared these with organizational realities. One faulty assumption was that people work in the interests of the organization when in reality they work first in their own self-interest, not in the interest of the organization. They stated that faculty members have to make decisions regarding time to learn new technologies when compared with the pressure to obtain tenure and research weighs more heavily than innovative teaching. The IT leaders have to understand and address the faculty's self interests at the same time as technology diffusion. The assumption that most institutions follow value-driven changes is countered with the reality that most organizations follow event-driven changes. The people within the organization should make changes that reflect the faculty's belief system and not pursue quick fix mentality to problems.

There is an assumption that most organizations center their energy on achieving performance results when the reality is that they equate activities with results. Performance improvement should determine results. There are a number of papers written on new course design, approaches, strategies and models with little research evaluating how preservice teachers' performance improves with IT training models. There is an assumption that people choose to be the architects of change initiatives in organizations when the reality is that people choose to be the victims of change rather than the architects of change.

Yang and Patterson (2005) give an example of a College of Education where the faculty repeatedly requested more faculty development yet when training workshops were offered, few actually attended. Afterwards there were still repeated requests for more faculty technology training. One effective faculty development initiative described included a multiple approach including: 1) improved access to technology by giving faculty laptops, 2) technology training which included 'brown bag' technology awareness series, formal workshops and one to one training, 3) mentoring in several combinations, faculty with faculty, graduate students, K-12 teachers and interns, and 4) incentives which included mini-grants and stipends for technology equipment, software, graduate assistance and travel grants for papers on technology and teaching. There is an assumption that organizations operate rationally when in reality organizations operate

non-rationally. They found that whoever controls the resources within an organization has the power to affect change initiatives.

### 2.5.9 Consequences of innovations

If the innovation is adopted or rejected there will be consequences that will affect the individual or the social system. Rogers (2003) indicates that consequences have often been neglected within research and the change agent. The reasons for overlooking the consequences include: 1) change agents often assume a positive change, 2) survey research methods do not adequately measure consequences; and 3) consequences can be difficult to measure. Consequences can be classified as 1) desirable vs. undesirable, 2) direct vs. indirect, and 3) anticipated vs. unanticipated. Rogers (2003) indicated that the equality or inequality of a social system is a consequence of an adopted innovation. He suggests that the digital divide is an example of inequity between nations because of the variation in access to computers and the Internet.

### 2.5.10 Models of change based on diffusion

Diffusion of innovation has been the basis for other models of change including the work by Hall and Hord (2006) who created the Concerned Based Adoption Model (CBAM), a system for implementing change in an educational environment. The CBAM is an approach to implement change within organizations. It was originally proposed in 1973 (Hall, Wallace & Dossett, 1973) and has been extensively used as a model of change within schools. Hall and Hord (1987) state that there are 7 assumptions that must be accepted: 1) understanding the point of view of the participants in the change process is critical, 2) change is a process not an event, 3) it is possible to anticipate much that will occur during a change process, 4) Innovations come in all sizes and shapes, 5) innovation and implementation are two sides of the change process coin, 6) to change something, someone has to change first, and 7) everyone can be a change facilitator (Hall & Hord 1987). The change facilitator can be a principal, a teacher or administrator and in the case of a Faculty of Education, a dean. Within the CBAM approach, there is a responsibility to probe and understand individuals and groups. Three dimensions, Stages of Concern, (SoC), Levels of Use, (LoU) and Innovation Configuration, (IC), have been identified through research. The data yielded by these measures gives the change facilitator

pertinent information that informs design of interventions that will facilitate the use of the new programs or practices (Hall & Hord, 1987).

Ely (1999) identified eight facilitating conditions that encourage the adoption of new educational technology within organizations. These conditions are: 1) dissatisfaction with the status quo, 2) existence of knowledge and skills, 3) availability of resources, 4) availability of time, 5) rewards or incentives exist, 6) participation, 7) commitment, and 8) leadership. Ely (1999) recognizes Rogers (1962) model of adoption of innovations as breakthrough within many fields however once an institution has adopted an innovation, the successful implementation of the innovation becomes important. He refers to Fullan as one of the lead scholars and practitioners of implementation of change within educational organizations.

Ellesworth (2000) completed a survey of educational change models that recognize diffusion of innovations (Rogers, 1962) as the leading model within research on change theory. Subsequent models created by other researchers follow Roger's diffusion of innovations and also contribute to change theory including Hall and Hord (1987) CBAM, and Ely's (1999) eight conditions. Ellesworth's (2000) framework to effective, lasting change includes using a systemic strategy that recognizes: 1) a change agent wants to communicate an innovation to an adopter, 2) a change process can be used to create a channel through the environment, and 3) resistance to change can disrupt the change process or distort how the innovation appears to the intended adopter.

### 2.5.11 Diffusion of innovation research within education

Diffusion of innovation theory has been used within many education studies (Rogers, 2003). There has been an abundance of innovations within education over the years. Lathem (1988) studied 27 innovative educational strategies and found similar characteristics on the birth and death cycles of educational innovations. Although the article does not deal specifically with technology innovations, it does speak to cycles of large numbers of new initiatives that teachers have experienced within schools under educational reform. He states that typically an innovation is started with great interest, implemented and peaks within a year and a half, and subsequently dies within four years. Lathem lists eight common characteristics why these innovations failed. 1) Practitioners are disenchanted and disillusioned and expect a quick fix to immediate and compelling

problems, however, the innovative strategy almost never meets the expectations. Some of the reasons for this include that using the innovation was more difficult than expected, too much change is required, too much discipline is required, and results are slow on coming. 2) Innovation supporters depart also taking their interest and enthusiasm. 3) Personnel lack training and enthusiasm. People are reluctant to take the responsibility of an innovative effort if it is not fully understood, they are not properly trained and there is no additional compensation. 4) Funds run out. Often the initiation of the innovation was supported with temporary seed money but it requires sustained support if it is to be adopted. 5) There is a lack of supervision of managing the project. 6) There is no accountability, especially once start-up funds are gone and the interest wanes in the innovation. 7) The supervisors let it be known that it makes no difference if the innovation is used or not, and 8) There is no consequence if the innovation is terminated.

Lathem (1988) suggests three proposals to encourage the success of innovations: 1) avoid innovation overload as often there are too many or a succession of innovations, 2) make sure the innovation is compatible with the school's philosophy and mission and not embraced with the hope of bringing money into the system, and 3) make sure the decision-making body approves and kept informed of the innovation. Cogan (2001) also describes the phenomenon of the over abundance of educational innovations that come and go within the schools and lists the many topic areas that are involved.

### 2.5.12 Diffusion of innovation as a conceptual framework

Shea, Pickett and Li (2005) use Rogers (2003) diffusion of innovations as a framework in their study of the diffusion of online teaching among 913 college faculty. Their results indicate that four variables are significantly associated with faculty satisfaction that would increase the likelihood of adopting online teaching. The variables include: levels of interaction in their online course, technical support, a positive learning experience in developing and teaching the course, and the discipline area in which they taught. They determined that the adoption of online teaching is dependent on the existence and success of faculty development and training efforts. Through faculty development, new faculty are made aware of the relative advantages, observability, and trialability of online teaching—these being key elements of the adoption process. The

complexity of online teaching, a challenge to the adoption of the innovation, is supported through human and technical resources including wizard driven online course templates.

### 2.5.13 Diffusion of innovation theory and technology within teacher education

Willis, Thompson and Sadera (1999) reviewed the research within the discipline of Information Technology and Teacher Education and described the historical development of various journals related to computers and education. They subdivided the literature into three main paradigms: empirical, critical, and interpretive. They suggest that more sharing of information is needed in "islands of excellence" in work on technology in teacher education, more case studies on diffusion of innovation, more emphasis on bias-related findings from critical theory, and more development and dissemination of resources and tools for using technology effectively. The literature they reviewed that related to diffusion of innovation research included: 1) Stuhlman's (1998; as cited in Willis, Thompson & Sadera, 1999) work with preservice teachers at Louisiana State University who conducted ten case studies that provided preservice teachers with models and examples of technology integration within an elementary school. The preservice teachers who had more contact with technology had more confidence in their ability to be successful teachers and supported a more student centered teaching pedagogy. 2) Thompson, Schmidt and Hadjiyianni (1995, as cited in Willis, Thompson & Sadera, 1999) describe several types of diffusion support of technology at Iowa State University. They noted that faculty required one on one support using graduate student mentors. 3) Strudler and Wetzel (1999) studied characteristics of technology in four teacher education programs using a case study approach. The recommendations include the need for carefully planned faculty development. Additional teacher education studies were reviewed in the article but without specific reference to ubiquitous laptop faculties of education.

Thompson, Schmidt and Davis (2003) developed a collaborative model of teacher renewal called TechCo developed using elements from different models of change, including diffusion theory. The new approach they developed for evaluating systematic change drew on three elements, a survey of the change models in education, (Ellsworth, 2000), a creation of an illustrated structure review based on European models, and

evaluation approaches for the engaged land grant university model of change (Silag & Fields, 2001) including Roger's (1995) diffusion of innovations.

Ellis (2004) recognized both Rogers (1995) diffusion of innovations and Hall and Hord's (1987) work on change theory in his dissertation on faculty development supporting preservice educators modelling ICT classroom integration. However Ellis' (2004) study was not situated in a Faculty of Education using ubiquitous computing.

### 2.5.14 Diffusion theory in ubiquitous laptop Faculties of Education

Within the literature of integrating ICT in Faculties of Education with ubiquitous computing, there was only one reference to Rogers' diffusion of innovation. Rader (2005), in her PhD thesis on foreign language preservice teachers' experience in a ubiquitous laptop Bachelor of Education program, discussed Rogers (1995) diffusion of innovations, and Hall and Hord's (2001) CBAM model before framing her thesis using Ely's (1999) eight conditions of this model to facilitate the implementation of educational technology innovations.

## 2.6 Summary

A review of the literature addressed three areas: 1) efficacy of laptop programs in education, 2) results with laptops in Faculties of Education with laptop programs and, 3) faculty development in the teaching of ICT. The question of efficacy of the laptop computer in education was addressed by examining studies that raised the concerns of technology use in the classroom. Cuban (1986, 2001) examined the history of technology in schools and the societal expectations that technology would improve education as a whole. He describes the technology cycle in schools and reasons why it failed to achieve the expected success.

The overall philosophical beliefs of technopositivism and its impact on society raised by Robertson (2003) and the computer myths suggested by Waller (2003) are used as reasons to question the introduction of technology into schools. The positive and negative effects of ICT on student achievement were examined as well as the concerns of using standardized tests in measuring the efficacy of the computer in the classroom.

As a tool, computer proficiency develops with increased use consistent with the Matthew Effect (Merton, 1968). Laptops offer the opportunity for increased use because of its portability (Brown, 2000), thus satisfying a need for individual freedom in society

(McLuhan, 1962). The complexity of the computers use in educational contexts requires knowledgeable teachers who have technological and pedagogical literacy meeting the standards set by ISTE NETS (2004), (UNESCO, 2002). Papert, (1987) was an early voice arguing for the potential for each child having their own computer.

Many educational institutions have recognized the potential learning power of the ubiquitous laptop environment and shared the lessons they have learned (Brown, 2000; Resta, et al. 2004). There have been a variety of approaches to encourage faculty to incorporate ICT into their teaching, including such strategies as faculty development, incentives, and mentoring. There is an extensive body of knowledge that exists in faculty development of which ICT in Faculties of Education is a small part. Effective faculty development is important in the successful integration of ICT into teaching (UNESCO, 2002).

Diffusion of innovation theory (Rogers, 1962; 2003) was chosen as the conceptual framework and it is summarized within the literature review. Related research on diffusion theory within education and technology and teacher education were described. There is little reference to diffusion of innovation research within studies of Faculties of Education with ubiquitous computing except for Rader (2005). It has been suggested that there is a greater need for diffusion research in studies of technology and teacher education (Willis, Thompson, & Sedera, 1999).

What remains unclear from existing research findings is: how are B.Ed. faculty learning to integrate ICT into their teaching, who do B.Ed. faculty communicate with in learning ICT, and what issues do faculty have in teaching preservice teachers in an environment that does not have formalized ICT standards. Much of the existing research on ICT integration has been found in K-12 studies or in universities. There is less research done in Faculties of Education with laptop programs, and even less in ubiquitous computing Faculties of Education in Ontario. More research can be done on the amount of ICT integration in schools by teachers who have graduated from a ubiquitous laptop Bachelor of Education. There still exists uncertainty in the efficacy of the laptop in educational settings.

# 3 Chapter 3 Methodology

## 3.1 Introduction

This research study uses a mixed methods design using both qualitative and quantitative methods in a single study (Cresswell & Plano Clark, 2007) to investigate the ICT integration teaching practices of faculty in a ubiquitous laptop B.Ed. program. It is unique to Ontario, yet lessons learned may be applicable to ubiquitous laptop programs in other Faculties of Education.

This chapter describes the historical situation of the case, a restatement of the research questions, the research design, the participants, and the measures of data. Concerns of the internal validity were addressed. The latter part of the chapter describes the mixed method approach incorporating both quantitative data and qualitative data in the analyses.

The university introduced a ubiquitous laptop program into the B.Ed. program in 2002 (Stewart, 2002; Weeks & Kariuki, 2003, Kariuki & Knaack, 2004) that was fully implemented by 2005, requiring all preservice teachers to lease a laptop. While teaching at the university in the B.Ed. program an emergent problem was recognized: the faculty was expected to teach using a laptop but many lacked previous training on the use of such technology and further, that they had limited experience in the integration of ICT into teaching. Many professors hired since the full implementation of the laptop continue to have a wide range of ICT experience and skills, from novice to expert ICT user. With the fast pace of change in the technology industry, much of the ICT often did not exist or has changed since the faculty taught in the regular classroom. Yet, despite this knowledge gap and changing technology landscape, many of the faculty were becoming skilled in the use of the laptop and were teaching preservice teachers how to integrate ICT into their teaching. The questions arose both of how the faculty was integrating ICT into their teaching and how they were learning ICT integration methods. This situation suggested the following research questions:

1. What ICT tools and methods are being used by Faculty of Education professors and how do they integrate ICT into their teaching?
2. How do Faculty of Education professors perceive they are learning how to integrate ICT into their teaching? What kinds of faculty development do they receive?

3. How does the professional environment support practices of professors' integration of ICT into preservice teaching at the university?
4. What are the issues that hinder the Faculty of Education professors when integrating ICT into their preservice teaching?
5. What changes to the B.Ed. program would facilitate Faculty of Education professors' integration of ICT into their teaching?

The research questions are framed to investigate the ICT integration into faculty teaching to preservice teachers within the ubiquitous laptop B.Ed. program. It is not a review or evaluation of the whole B.Ed. program, but rather focuses specifically on the processes by which the faculty members integrate ICT within their teaching and how they are learning to teach with ICT. By understanding these existing processes, identifying some of the barriers and suggesting potential solutions, this knowledge could be used to improve faculty pedagogy and thus ultimately impact the quality of education preservice teachers receive within the laptop B.Ed. program.

## 3.2 Participants

The university had 55 full-time and part-time faculty teaching approximately 700 preservice students in a one-year consecutive ubiquitous laptop B.Ed. program in 2006-2007. Twelve hours of class time in the program is utilized specifically for Computers (ICT). There are varied amounts of integration of ICT into all other courses depending on the course and the professor.

### 3.2.1 Interview participants

In this study, seven faculty, thirteen preservice teachers, two technical assistants and one senior administrator were interviewed. Pseudonyms were used for all participants to preserve confidentiality.

### 3.2.2 Faculty interview participants

Seven faculty members, five females and two males, who taught in the 2006-2007 B.Ed. program were invited by email, phone or personal communication to volunteer for an interview. Purposive sampling is a method used by researchers to obtain an accurate representation of the population, and a convenience sample is a group of relevant individuals who are available for the study (Fraenkel & Wallen, 2000). The current

sample was both a selection of convenience in that the faculty was willing to be interviewed, but also purposive to include the following four criteria:

a) At least one representative from each of the three divisions (Primary/Junior, Junior/Intermediate, and Intermediate/Senior) was chosen to ensure a cross section of the education faculty as a whole. There was some overlap as faculty can teach in more than one division at a time. Irene and Aimee taught in the Primary/Junior division, Karon, Brenda, Kevin, Joan, and Dan taught in the Junior/Intermediate division and Dan, Karon and Kevin also taught in the Intermediate/Senior Division.

b) A representative who teaches Computers or ICT integration in the B.Ed. program. It was assumed that this individual should be among the most knowledgeable in integrating ICT in the program. Kevin volunteered to be interviewed. He teaches the 12 hour computer course in both the Intermediate Senior and Junior Intermediate divisions. He is also member of the ICT committee and is involved in the organization of the laptop program.

c) A representative who had been employed at the university prior to the implementation of the laptop initiative. It was expected that a more experienced professor would be able to better situate the historical background of the laptop initiative implementation. Brenda has taught at the university since 1990, prior to the inception of the laptop program in 2002.

d) A representative faculty member who had recently started teaching since the laptop program was established. A newly hired professor might be in a better position to describe problems encountered when beginning to teach in an existing laptop program. Karon, Dan, and Aimee were recently hired faculty, teaching in their second year at the Faculty of Education.

### 3.2.3 Preservice teacher participants

The preservice teachers were 2006-2007 graduates of the university's B.Ed. program. Thirteen preservice teachers, representatives of the Primary/Junior, Junior/Intermediate and the Intermediate/Senior divisions, volunteered in one of the four focus group interviews conducted over a two week period shortly after they had completed the B.Ed. program.

### 3.2.4 Technical assistants

A former graduate of the B.Ed. program, Josephine, was hired in 2003 to work in the Faculty of Education as a technical assistant to provide both ICT assistance and professional development to both students and faculty. Josephine was interviewed to find out what kinds of support she gives the faculty and students in her role as a technical assistant.

Jim works directly under the president of the university in the role of overall faculty support. Jim is a retired Faculty of Education professor and assists both Faculty of Education and Faculty of Arts and Science in maintaining faculty websites and improving faculty teaching practices. Jim was interviewed to find out what support he gives the faculty.

### 3.2.5 Administration participant

The Dean of Education was interviewed to determine the role that administration has played in faculty integration of ICT into teaching.

### 3.2.6 Faculty survey participants

All full time and part time Faculty of Education professors during 2006 - 2007, 55 in total, were personally invited by email (Appendix G) in mid August of 2007 and were given two weeks to complete the anonymous online survey. This was followed with a reminder announcement at a faculty meeting and a further email to those who had not completed the survey. Four of the 2006-2007 professors were no longer working at the university by the end of the summer and did not participate in the survey. This strategy resulted in 39 out of 55 participants, (71%), attempting the survey and 36 fully completing it.

## 3.3 Methods of data collection

This mixed method study uses both quantitative and qualitative measures including; interviews, focus groups, a faculty survey, and course outline documentation. “The use of quantitative and qualitative approaches in combination provides a better understanding of research problems than either approach alone.” (Cresswell & Plano Clark, 2007, p. 5). In the first phase, the qualitative data gathered in the interviews explored the phenomenon, namely the processes of ICT integration into teaching by B.Ed. faculty, which in turn informed the development of the quantitative survey

instrument. An Exploratory Design is useful when a researcher needs to design and test an instrument when one is not available (Cresswell & Plano Clark, 2007).

The interviews and the survey were conducted with participants representing four levels of the university structure in order to develop a thick descriptive account of the goals and interests of the participant groups and how these informed the practice and perceptions of technology integration.

## 3.4 Data sources

### 3.4.1 Interviews

The interview questions were based on research conducted by Paul (2004) who had investigated writing instruction and faculty development within a group of University communications professors in the United States. The interviews in the current study were semi-structured, designed to obtain information that can be compared and contrasted (Fraenkel & Wallen, 2000). Individual questions were asked to confirm, clarify, and further develop information regarding the integration of ICT into the B.Ed. program. All interviews were recorded using a digital recorder and later transcribed into Microsoft Word. Transcriptions of interviews were sent via email to faculty, technical assistants and administration as a member check.

#### 3.4.1.1 Faculty interviews

Faculty interviewees were asked to present and discuss their level of ICT integration and some of the successes and challenges experienced in integrating technology into teaching. Questions explored the ways in which they engaged in faculty development related to ICT; how they learned technological skills and strategies most effectively; and faculty members' perceptions of the ICT culture and community at the university. Faculty interview questions are found in Appendix B and the consent form is in Appendix I.

#### 3.4.1.2 Preservice teacher interviews

Thirteen recent graduates of the B.Ed. program participated in one of four different semi-structured interview focus groups to discuss their views of integration of ICT by faculty within the B.Ed. program. The preservice teachers were chosen to get their views of the strengths of the ITeach program and to identify areas that could be

improved. Preservice teacher interview questions can be found in Appendix E and the consent form is in Appendix L.

#### 3.4.1.3 Technical assistant interviews

The technical assistants work closely with preservice teachers and faculty. Semi-structured interviews carried out with both technical assistants. The technical assistants were chosen because they would likely have insight into many of the concerns of the preservice teachers and faculty regarding ICT integration. The technical assistant interview questions can be found in Appendix C and the consent form is in Appendix K.

#### 3.4.1.4 Administration interview

The Dean of Education represented the administration and volunteered to be interviewed. Administration was chosen to achieve a greater comprehension of the interacting levels of systems regarding ICT integration within the B.Ed. program from someone who has a role in some of the decision making as well as the interactions with external systems such as schools and the Ontario Ministry of Education. Administration Interview questions can be found in Appendix D and consent the form is in Appendix J.

### 3.4.2 Faculty online survey

While a full and appropriate survey instrument was not available from the literature some questions and results from Kay (2007) were used in developing the survey instrument for this study. Kay's study examined the effectiveness of ICT learning strategies used by preservice teachers in a ubiquitous laptop program in an 8 month consecutive Faculty of Education in Ontario. Additional information from Kay's (2006) meta-analysis of 68 refereed journal articles that focused on introducing technology to preservice teachers was also used in framing the survey instrument.

The online survey was pre-piloted and piloted with participants who would not compromise the sample and any suggestions from these participants were reviewed and implemented. Cohen, Manion and Morrison, (2001) emphasize the importance of pre-piloting and piloting a survey to fine-tune the questions around the major research questions of the study. Feedback from the pre-pilot was used to modify questions that were unclear and an average time to complete the survey was established. During the pilot testing, the survey instrument was tested with 10 people and the length of time to complete the online survey was 23 minutes. With the B.Ed. faculty, the length of time

ranged from 15 minutes to over 45 minutes depending on how detailed the responses were to the open ended questions. The average time for the faculty to take the survey was 28 minutes. A personal email invitation (Appendix G) was sent out to all 55 faculty who taught in the B.Ed. program in 2006-2007 with a link to the survey embedded in the email. The survey could be answered and completed on any computer connected to the Internet. The data collection website www.surveyconsole.com was used to gather, collate, and conduct simple statistical analyses of these data. A consent form was the first page of the survey and by continuing to complete the survey implied consent (Appendix H).

Within the online survey, Faculty of Education professors were asked to include demographic information such as gender, age, and years of experience. Using a five point Likert scale, they identified their comfort and expertise with various ICT skills prior to coming to the University, how and what they have learned in ICT since being at the university, and how much they believe that technology is being integrated into the courses they are currently teaching. Questions were also included on how they learned ICT, how they integrated it into their teaching as well as whom they asked for assistance. Faculty were asked to rate the overall level of faculty development and to offer suggestions for additional support and improvement. Finally, they were asked if they were familiar with the ISTE NETS for teachers. The B.Ed. faculty online survey questions can be found in Appendix A and the consent form is in Appendix H.

### 3.4.3 Documentation

Documentation data in the form of B.Ed. preservice ICT assignments gathered from course outlines were collected. An assignment incorporating ICT offers an outcome to determine whether preservice teachers are using ICT in ways consistent with the approaches described by the faculty. This measure involved asking the interviewed faculty and those who participated in the online survey to describe the assignments they used that integrated ICT. Preservice teachers in their interviews were also asked what assignments they had experienced that incorporated ICT. A list of assignments was compiled from the transcripts of the interviews. Comparing the reports from these participant groups and the assignment list offered a means of triangulation, using multiple

data-collection methods, to identify inconsistencies or contradictions among findings about the same phenomena (Gall, Gall & Borg, 2005).

### 3.4.4 Memo writing

Glesne (1998) states that, by the researcher using memo writing, "you develop your thoughts, by getting your thoughts down as they occur, no matter how preliminary or in what form, you begin the analysis process" (p. 131). Two forms of memo writing were used in this study. Ideas and thoughts regarding the research study were written down on a notepad or typed and saved in computer in Microsoft Word files. This writing process was ongoing from the beginning of the research project, continuing during the data collection and analysis, through to the completion of the thesis. These observations and notes serve as another check on interpretation and another means to verify interpretations of data.

## 3.5 Internal validity

Validity refers to "the appropriateness, meaningfulness and usefulness of the specific inferences made based on the data collected" (Fraenkel & Wallen, 2000, p. 169). There are four main threats to internal validity in survey research: mortality, location, instrumentation and instrument decay (Fraenkel & Wallen 2000). In terms of mortality, the survey was launched in the middle of August 2007 and four faculty members had either retired or moved and did not respond to the survey. The survey location was at any Internet connection and could have been either at the university or at home. Location was not a concern because the instrument was Internet-based. Instrument decay can occur if the participants are rushed. However, in this case faculty members could take their time in completing the survey. Instrument decay was not a concern as the instrument and scoring procedures were not changed during the data collection. Participant's attitudes may have had a minor impact.

While it was stated in the survey introduction that it would take about 20 -30 minutes to complete and the average time to complete the survey was in fact 28 minutes, there was one written complaint by a faculty member claiming the survey was too long. Additionally, there were two verbal complaints afterwards about the length. Three participants did begin the survey but failed to complete it. Item non-response is common within surveys for many possible reasons (Fraenkel & Wallen, 2000). Most quantitative

questions had at least 36 replies and there was ample qualitative data from the open ended questions. All data collected was used and partial completion of surveys did not affect the results.

Steps were taken to control the internal validity. The concern of time lapsed as a threat to internal validity was addressed by interviewing recent graduates of the B.Ed. program. Four separate focus groups were conducted with similar responses to interview questions recurring within each of the groups.

The faculty interviews were completed first and were followed up with similar questions within the faculty online survey which supported some of the data collected within the interviews. Documentation from faculty course outlines elaborated the data collected regarding ICT assignments thus helping to validate both interviews and online survey results.

The faculty survey was anonymous with a completion rate of 71%. This exceeds the 50% response rate considered by Dillman (2004) as acceptable for online surveys. Seven of the fifty-five faculty were interviewed, representing approximately thirteen percent of the population. The faculty interview participants were purposively chosen to represent, length of service, age, gender, and the division that they teach in to obtain a cross section of the B.Ed. faculty population.

Faculty, administration and technical assistant interviews were transcribed and rough transcriptions were sent to participants as member checks. No concerns arose although one faculty member wanted to be sure that grammar and punctuation were correct on any direct quotes.

### 3.6 Analysis of data

"Analyzing the data in a qualitative study essentially involves synthesizing the information the researcher obtains from various sources into a coherent description of what he has observed or otherwise discovered." (Fraenkel & Wallen, 2000, p. 505). Deciding how the qualitative and quantitative data are mixed is an important procedural consideration as well as the timing and weighting (Cresswell & Plano Clark, 2007).

The interviews were transcribed from the digital recorder into Microsoft Word documents. The interview data were initially summarized and categorized within the

framework of the research questions. Qualitative data from the open ended survey questions were also categorized within the framework of the research questions.

Quantitative data from the survey were analyzed using the surveyconsole.com analysis tools which provide descriptive statistical analyses. These include frequency analyses, completion rate, mean, standard deviation, contingency analysis including cross tabulation between questions. The surveyconsole.com data were imported into Microsoft Excel, formatted and were analyzed using SPSS version 15.0, a statistical analysis package.

When choosing a mixed methods design, weighting must be considered in giving priority to either the qualitative or the quantitative data collected in answering the study's questions (Cresswell & Plano Clark, 2007). Although the initial intentions were to give equal weighting to both the quantitative and the qualitative data collected, the qualitative data received a greater priority as they provided richer description through the interview process (Cresswell & Plano Clark, 2007).

## 3.7 Summary

Chapter Three describes the methodology for data was collection and analysis. Faculty of Education professors participated in an online survey regarding their beliefs and practices of ICT integration in their teaching. Interviews were then conducted with volunteers including: seven faculty members, two technology assistants, administration (Dean), and thirteen recent preservice teacher graduates in focus group settings. Quantitative data was analyzed through the online website surveyconsole.com and SPSS 15. Chapter Four describes the findings of the study.

# 4 Chapter 4 Results

## 4.1 Introduction

The analyses are based on data collected from the online survey of the B.Ed. faculty that yielded both quantitative and qualitative information. Further data was collected through the semi-structured interviews of seven faculty members, two technical assistants, the senior administrator, and student focus groups comprised of graduates of the 2006-2007 B.Ed. program. Pseudonyms are used throughout the study. Data gathered from the faculty survey and interviews was analyzed to determine how the Faculty of Education professors integrate ICT into their teaching. Data was analyzed from interviews from recent B.Ed. graduates, technical assistants and administration to either confirm or conflict with the faculty data to get a balanced understanding of the answers given to the research questions.

The analysis of the data was organized into five themes based on Rogers (2003) diffusion of innovations. They include:1) innovations used by faculty: which describe the attributes of the ICT innovations and their integration; the frequency and use of ICT by the faculty, 2) the adoption of the innovation, which describes how the faculty perceive they are learning about and integrating ICT, the communication channels, and diffusion networks, 3) how the organizations support the innovation and the integration of ICT, which describes how the technical infrastructure and staff support both faculty and preservice teachers in ICT, 4) unexpected consequences of the innovation, which summarizes eight main issues in ICT integration that were concerns of both faculty and preservice teachers, including areas where the learning of ICT integration fell short of expectations, and 5) increasing the adoption rate of ICT integration; which outlines some of the successes faculty have had on the integration of ICT and suggestions how to improve the diffusion of the innovation. The last theme also focused on the practicum experience of the preservice teachers, determining if the innovation is having its expected outcomes, determining if what the faculty members have taught at the university can be authentically applied in the school classroom.

## 4.2 Survey results

The B.Ed. faculty members are the core participants. There were 55 faculty teaching in the 2006-2007 consecutive Faculty of Education program. In the online

survey, the 39 faculty participants consisted of 22 females (56%) and 17 males (44%). Most of the participants, 56%, were between the ages of 41-50. The majority of the faculty, 31, had six years or less teaching at the university with seven having only one year of experience. All faculty members have some experience in teaching in the regular schools system, 16% having 1-5 years, with the majority, 84% having more than 5 years teaching experience in the regular school system.

The implementation of the laptop program started in 2002, with 61% of professors being hired subsequently. The following are the number of years the individual faculty members have taught at the university as of August 2007, for less than five years: one year: 18%, two years: 10%, three years, 18% , 4 years: 5% and five years: 10%. This leaves 39% who have taught for more than five years, and have been teaching since the beginning of the implementation, six years: 18%, seven years: 5%, 8 years: 3%, nine years: 0%, and ten or more years: 13%.

The majority, 54% had no previous teaching experience at other post secondary institutions indicating that teaching at the university would be their first time, while 38% had from 1-5 years post-secondary teaching elsewhere. Only 5% indicated they had 6-10 years of previous experience while only one person had between 16-20 years of experience elsewhere. Faculty indicated that only 81% had attained a Masters degree and 57% had a completed doctorate. The rank of 37 faculty members who completed the study indicated that 5 were part-time, 1 was a lecturer, 28 were assistant professors and 5 were associate professors. There are no full time professors teaching in the Faculty of Education.

The following are the demographics of the seven faculty interviewees. Irene is a 43 year old female and has been teaching at the university for five years. She teaches language, literacy and drama in the Primary Junior division and Additional Basic Qualification (ABQ) courses as well as special education in the Additional Qualification courses in the spring. Irene ranks her ICT skills as high. She has almost completed her PhD. Karon is a 34 year old female and has been teaching at the university for two years. She teaches Physics, Mathematics and Science in the Junior Intermediate division and Senior Physics ABQ in the spring. Karon is working on her PhD. Kevin is a 46 years old male and has been teaching at the university for four years. He teaches Computers in the

Methods course and as well as the Intermediate Senior Computer Science Elective. Kevin also is the ICT coordinator of the ITeach program. Kevin is working on his PhD. Joan is a 41 year old female and has been teaching at the university for five years. She teaches Methods and Management in the Junior Intermediate division and has a PhD. Donny is a 40 year old male and has been teaching at the university for two years. Donny teaches Methods in the Intermediate Senior division and has a PhD. Brenda is a 54 year old female and has been teaching at the university for 17 years. Brenda teaches Educational Psychology and Special Education in the Junior Intermediate division and has a PhD. Aimee is a 61 year old female and has been teaching at the university for 1.5 years. She teaches Language Arts in the Primary Junior division and is replacing a professor who has gone on leave. Aimee has her M.Ed. degree.

### 4.3 Innovations used by faculty

The laptop as an innovation is seen as a technology cluster that contains a multitude of distinguishable innovations, many that can be located on the machine as well as others that can be used via the Internet. There are additional peripheral tools that can be used in conjunction with computer. Faculty had the opportunity through the survey to indicate frequency of use of nineteen different innovations as well to list additional applications not listed. To determine which innovations were adopted, the faculty members were asked, “Which of the following technology skills do you integrate into your teaching at the university?”

The following ICT skills and tools were integrated within their teaching followed by the mean score (in brackets) derived from a Likert scale out of 5, selected from the choices of: Never, Rarely, Sometimes, Often, and Very Often: Internet to retrieve information (4.378), presentation software, (4.33), word processing (4.027), Internet to retrieve research articles (3.973), email (3.784), storage of data on CD (3.73), keyboarding (3.543), course related software programs (3.486), multi-media presentations (3.162), website development, (2.838), spreadsheets (2.529), desktop publishing (2.514), WebCT course development (2.297), graphics software (2.135), Webquests (1.865), online course development (1.676), Smartboard (1.622), GPS (1.541) and Synchronous chat (1.472). Listed in Table 1 are the ICT skills and the count, which is

the number of professors who answered the question. Table 1 illustrates this data collected from the survey.

**Table 1:**
**List of ICT Skills Faculty Integrate in Their Teaching**

| | ICT Skill | Count | Mean |
|---|---|---|---|
| 1. | Internet to retrieve information | 37 | 4.378 |
| 2. | Presentation software (i.e., PowerPoint) | 36 | 4.333 |
| 3. | Word Processing (i.e., MSWord, WordPerfect) | 37 | 4.027 |
| 4. | Internet to retrieve research articles | 37 | 3.973 |
| 5. | Email | 37 | 3.784 |
| 6. | Storage of data on CD | 37 | 3.730 |
| 7. | Keyboarding | 35 | 3.543 |
| 8. | Course related software programs | 37 | 3.486 |
| 9. | Multi-media presentations | 37 | 3.162 |
| 10. | Website development | 37 | 2.838 |
| 11. | Spreadsheets (i.e., Excel) | 34 | 2.529 |
| 12. | Desktop publishing (i.e., MS publisher) | 37 | 2.514 |
| 13. | WebCT course development (or similar program) | 37 | 2.297 |
| 14. | Graphics software (i.e., CorelDraw) | 37 | 2.135 |
| 15. | Webquests | 37 | 1.865 |
| 16. | Online course development | 37 | 1.676 |
| 17. | Smartboard | 37 | 1.622 |
| 18. | GPS | 37 | 1.541 |
| 19. | Synchronous chat (e.g. MSN, Yahoo) | 36 | 1.472 |

The following comments from the faculty survey indicated the extremes of faculty expertise in the integration of ICT into teaching. This would indicate the varying degrees of adoption of ICT among faculty. Here is a comment by a faculty member willing to adopt, but who requires assistance yet because of the complexity of the innovation:

> I don't know much about the computer programs that students are using. I think there is an assumption that because we are using a laptop program, we are current in our knowledge and expertise. I am learning what I can to participate and my learning curve is steep and at times very frustrating. The students are encouraged to use what they are learning and to assist each other when they are working on tasks requiring the use of computer and often to come to my aid! (Faculty survey, 2007)

At the other extreme, this faculty member appears to have fully adopted the laptop within his/her teaching. The use of cooperative games embedded within a PowerPoint presentation could be considered an example of reinvention (Rogers, 2003) indicating a creative use of the technology.

> I use PowerPoint on a regular basis as a tool to organize my lessons - even cooperative games are included in the PowerPoint at the relevant time. Each PowerPoint is coded for the ease of students - this is for your notebook, this is for your final assignment, this is a listening game, this is guided reading. The more we provide the organizational structures in the implementation of lessons, the less guesswork there is on the part of the students. All relevant files are hyperlinked at the right location (e.g., websites). Microsoft documents are used to share information as well as to serve as a template for assignments and note taking. Students are taught to use the technology by using it for real purposes in the classroom. (Faculty survey, 2007)

In addition to tools used directly on the computer, other peripheral devices were used in educational contexts. The faculty members were asked if there were additional ICT tools integrated into their teaching and what those were. The following additional ICT skills and tools were integrated within their teaching followed by the mean score (in brackets) derived from a Likert scale out of 5, selected from the choices of: Never, Rarely, Sometimes, Often, and Very Often: printer (4.47), data projector (4.44), USB key (3.94), video (3.42), scanner (2.86), digital camera (2.77), assistive technology (1.83), MP3 player (1.69), scientific measuring devices (1.53), Smartboard (1.42), Palm pilot (1.42) and AlphaSmarts (1.14). Additional peripheral ICT devices listed as other include DVD, websites, discipline based software, and webcams.

Table 2 summarizes the frequency faculty use ICT in their teaching based on the categories developed by Russell et al. (2006) followed by the count (number of responses), mean score (in brackets) derived from a Likert scale out of 5, selected from the choices of: Never, Rarely, Sometimes, Often, and Very Often. Generally, ICT is well used in the following areas: preparation (4.75), implementation (4.47), assessment (4.44), communication with preservice teachers (4.40), and classroom use (4.19). The lower score for assistive technology (2.62) may be smaller as not all professors had special needs students in their class. There is also only a single Special Education professor per division who would be teaching about assistive technology.

**Table 2:**
**Faculty Use of Technology**

| | Question | Count | Score |
|---|---|---|---|
| 1. | Lesson preparation | 36 | 4.750 |
| 2. | Lesson Implementation | 36 | 4.472 |
| 3. | Assessment (recording marks) | 36 | 4.444 |
| 4. | Communicate with preservice teachers | 35 | 4.400 |
| 5. | Preservice teachers use information and communication technology in your class | 36 | 4.194 |
| 6. | A preservice teacher with special needs | 34 | 2.618 |

The faculty gave assignments requiring the integration of ICT by preservice teachers. An assignment that integrated ICT would typically have the preservice teacher use the innovation. In the online survey, the faculty was asked how many of their assignments given to preservice teachers required them to integrate ICT? The results are in Table 3. All respondents surveyed indicated that they had varying degrees of integration of ICT into their assignments. Education professors were asked to list assignments that integrated ICT. The description of assignments listed indicate a variety of ICT skills were used in creating assignments but predominantly word processing and presentation software.

The course outlines were analyzed and summarized to include assignments that integrated ICT. The course outline summary included more assignments that were listed in the survey and interviews combined. This could reflect that some of the faculty did not participate in the online survey. The course outlines indicated a greater detailed description of the assignments compared to either the surveys or interviews. This could be as a result of professors requiring a more detailed description to inform preservice teachers of assignments.

All professors required at least one assignment that integrated ICT. Fifteen of the faculty had some, 13 had most, 6 required that all of the assignments integrated ICT while only 2 faculty members had a few. Table 3 indicates the number of faculty requiring assignments that integrated ICT.

**Table 3:**
**Number of Faculty Requiring ICT Integration in Assignments**

| Answer | Count | Percent |
|---|---|---|
| None | 0 | 0.00% |
| Few | 2 | 5.56% |
| Some | 15 | 41.67% |
| Most | 13 | 36.11% |
| All | 6 | 16.67% |
| Total | 36 | 100% |

Evidence of integration of ICT into teaching can be found in the assignments that faculty have preservice teachers complete. Table 4 is a summary of qualitative data from the faculty survey listing the assignments used in the B.Ed. program that integrate ICT. A list of assignments was collected from course outlines found on faculty websites and compared to assignments listed in the survey.

**Table 4:**
**Summarized Examples of Faculty ICT Assignments From Survey**

1. Electronic literature portfolios, desktop publishing
2. Word, word processing, PowerPoint presentations, Multimedia, video clips
3. Excel, spread sheet assignment, data base assignments
4. Exams, tests, written on computer
5. Internet search of web pages, WebQuests, downloads from faculty website,
6. Website development
7. Assignments handed in on CD, email attachment, email
8. Scientific ICT accessories, LoggerPro, TI 83 calculators, GPS
9. Math manipulatives and technology, Geometer's sketchpad
10. Software evaluation
11. WebCT, Online lesson, online survey, online test, online contests
12. Digital cameras, Photoshop
13. Ontario Curriculum Unit Planner (software)
14. Use of assistive and adaptive technology for special needs
15. IEP's using Ministry of Education software
16. Graphic software, Smartideas
17. Audacity software, downloading music, YouTube,
18. Digital recording of lesson and self evaluation
19. CAI and CMI lesson plan
20. Business related software, Simply Accounting
21. Markbook (Assessment software)

This triangulation indicated that the actual number of ICT assignments listed on the course outlines were greater than those listed in the survey. This difference could be explained by realizing not all faculty members participated in the survey and those that did perhaps did not fully indicate all of their ICT assignments.

Irene does not formally integrate or teach ICT. It is her philosophy to integrate it naturally. She discussed the writing process and how it was done by hand and now it can be done through editing on the computer. The skill of keyboarding is not taught as she assumes that all preservice teachers know how to type. She teaches the preservice teachers how to avoid plagiarism, and the use of appropriate websites. When discussing students with special needs, Irene teaches the use of assistive technology and how teachers should be familiar with the speech to text function. She speaks about technology, but in reference to practical applications in the classroom such as reading, running records and reading portfolios. She teaches how they can put pictures into PowerPoint and then have the students talk their story to the computer so that they are creating a talking book. She has talked about the importance of having computers in the classroom rather than a computer lab in a school so they can go to the computer when it makes sense, rather than a scheduled computer time. Through assignments the students are expected to incorporate technology. One of Irene's assignments is the creation of an electronic litfolio (literature portfolio) created using Microsoft Publisher.

One method on how Irene integrates technology into her teaching is through modeling, which is an effective method to teach preservice teachers pedagogy that they will use in their own practice (Lortie, 1975; Weeks & Kariuki, 2003). Irene describes how she integrates ICT into her teaching:

> We don't sit down and formally say, 'Okay how can we integrate technology?' For us it's become something we do. Because it's there, and it's our philosophy to integrate it naturally, for us it's not something we sit down and say, "Okay let's do it". We know it's out there and we provide as many opportunities as we can, in the same way that we want them to see them doing it in the classroom. It's, "How can we use it as a tool to best teach the students in the classroom?", my students (preservice teachers), and also their students. We operate on a model, that students need modelling, they need you to see them doing it. Don't ask a student to do something you are not willing to do yourself. If you go up there and show them how to do it and give them the meaning and the purpose for it, it makes a lot more sense. (Irene, 2007, interview)

Karon integrates the following ICT tools into her teaching; Microsoft Word, PowerPoint, Excel, Logger Pro, some Physics probes, MP3 players, and MarkBook, an assessment software. She has her Math preservice teachers use the Voyage 200 and the TI83 calculators and have them become familiar as they are supposed to be used in the

schools. With assignments, she has her students create culminating activities, which incorporates technology. She feels if an ICT tool will be effective in a classroom then she will teach her preservice teachers how to use it. Karon has a website and has the website technician update the website.

Kevin teaches 12 hours of computers to all of his classes so the course is a concentration of ICT. Kevin's method of integrating ICT is stated:

> What I try to do in the education technology course is, I'm a big believer in incremental progress in terms of technology skill development. So when students enter the course in September, I try as much as possible to model for them what I hope eventually they will achieve and that is the ultimate definition of excellent integration of technology; is when technology is kind of invisible. You are doing your thing and technology is there, who knows maybe just recording something or helping you discover new information, but it's kind of invisible. So what you try to do in this course is present an example in each class of an integrated activity, giving a chance to reflect on that and see if it connects with their domain in terms of their subject specialization or the age group they are working with. (Kevin, 2007, interview)

Kevin was a believer in people first, curriculum and technology second. He had an assignment where preservice teachers worked in small groups using digital cameras to share and record information about themselves, taking pictures to put in their profiles and find out how they felt about technology. He wanted the technology to blend in to the lessons and not be a main focus of the lesson. The technology was a tool to find out more information about individuals.

The students had opportunities to create websites where they marketed themselves as a preservice teacher. They created newsletters to be utilized in their practicum classrooms as a communication device to be used with the class and their families. They were asked to teach a lesson using technology in their practicum if it was possible. The reality was that in some schools, because of the lack of technology in the classroom, the student could not integrate ICT into their lesson.

Kevin felt positive on the use of technology but stated it should not be forced to be used in every class. He did not feel that they should be sitting in front of a computer in a Phys. Ed. class, but perhaps looking up nutritional analysis in a health class. Kevin maintained his own website. He has used online quizzes before, but stopped using them regularly as some of the feedback on evaluations stated that preservice teachers did not

like to use the online quizzes all the time. He used feedback to adjust his teaching practice.

Joan taught the students about the report card, Ontario Curriculum Unit Planner, online rubric makers, assessment software such as ETeacher and Markbook, Microsoft Word in lesson planning and maintained her own website where students could download templates. She has had her preservice students search the Internet for resources as well as the Ontario Ministry of Education website. She utilized PowerPoint and a data projector when teaching and posted her lessons on her website. She communicated through email with her students.

On integrating ICT, Joan felt that the laptop was a tool for teaching but not in lieu of teaching. She felt it was imperative that the students use the technology to gain practical experience and to problem solve.

Donny used PowerPoint presentations in class which could also be downloaded from his website. The preservice teachers could also download a 99 page document which included all his notes for the year. One of Donny's assignments was to have preservice teachers record themselves teaching in a classroom and analyze their communication skills. Preservice teachers would use PowerPoint, data searches, documents that had to be modified using word processing, DVDs, and videos in his class. One piece of software, Smart Ideas was introduced later in the year but through preservice feedback in professor evaluations, he found that this software was so valuable that he introduced it in the second week of teaching.

One of the concerns that Donny had was that the faculty do not 'practice what they preach' in terms of integrating ICT into teaching. The course time constraints seem to restrict the professors to resort to teach in a lecture style rather than modeling the teaching method.

> Practice what you preach. We are teaching them all these new and innovative things and then just lecturing. They see the irony in it too. It's always a challenge because we only have a short time with them, but 'Teach it this way, but I'm showing you this way.' (Donny, 2007, interview)

Brenda had a website that the students found helpful. She kept it password protected and the students shared the information with others. She had an assignment using ICT and this worked well.

Aimee had a website that the students could use to download her PowerPoint lessons. Aimee used PowerPoint presentations in class and the preservice teachers searched the Internet for various websites including the International Reading Association and the Ontario Ministry of Education as well as strategies on the OCUP.

Faculty integrated ICT into their teaching in various ways depending on the subject area as well as the strength of their ICT skills. When asked on the frequency of the discussion of ICT integration with preservice teachers, Irene's comments reflect more of a seamless integration of ICT and what it can add to the writing process rather than it being an isolated entity.

> I can think of specific instances that we do talk about technology and the writing process. Many of the students [preservice teachers] remember when they were handwriting, first draft, second draft, editing, revision and they remember hand writing over and over and over again, first draft, second draft. So we talk about it very explicitly then and we talk about the editing on the computer, so their students aren't continually writing over and over again. We show them how to cut and paste pictures from the Internet. We talk about different ways they can avoid plagiarism and ensuring that the students understand what an appropriate website is. (Irene, 2007, interview)

The power of the computer is described within this statement with its benefits as well as its new concerns. What Irene indicates is that she taught writing through word processing using ICT, and the potential to add pictures from the Internet which would involve research. With this new technology being introduced to her classroom makes her think about plagiarism and the appropriateness of websites. As one teaches the additional skills of using ICT in the writing process, these changes create other concerns that must be addressed.

### 4.3.1 B.Ed. graduate comments on faculty integration of ICT

The preservice teachers were recent graduates of the B.Ed. program in 2007 and were interviewed in focus groups to provide a parallel perspective on responses gathered through the faculty survey and interviews. Methodical triangulation through multi source data collection may increase the validity of the study (Cohen, Manion, & Morrision, 2000). Through these interviews, the B.Ed. graduates were asked to consider the role the faculty played in teaching them how to integrate ICT into their teaching. Their expectations of faculty's role was to; demonstrate methods of ICT integration into each

of the subject areas, teach how to use software programs that could be used in the classroom, communicate necessary information, describe the advantages and disadvantages of technology, teach how to trouble shoot and solve problems, and model the use of technology. Faculty use of the innovation within the classroom or through assignments is the main communication channel through which preservice teachers learn knowledge of the innovation. How the innovation is presented may encourage the preservice teacher to use it in their own classroom. There may also be opportunity to try an innovation either in the classroom at the university or within the practicum at a school.

The B.Ed. graduates were also asked what they perceived the role of the professor who taught the Computer course was in the program. This question was asked based on the assumption this professor would actively be demonstrating the use of the laptop within the teaching environment and there would be a higher likelihood of modeling of ICT integration into teaching. They stated that the 12 hours of computer class should be longer as it only scratched the surface on certain programs such as Markbook and Dreamweaver. Some of the software programs were practical but they did not have the opportunity to use it in the practicum. For example, Markbook was not used in the practicum nor was the report card. Some preservice teachers felt they might forget how to use these programs once they began teaching.

The course assignments were found to be useful but since there were only 12 class hours, they felt there were too many assignments requiring a significant amount of work for the value of the mark. For example, the weighting for the website assignment was worth 1% of the total mark of the course. The amount of time spent on creating a website was valuable but should be weighted similarly to assignments in other courses.

Sabrina stated that her Geography teacher was very much into integrating ICT into the lessons. They had a computer-assisted lesson and then a computer managed lesson. The computer applications used included Google Earth and arcview.

George stated that, in his history class, he was given an interesting assignment where they were given a list of Canadian names in history and then a list of quotes and they had to use the Internet to match the connections. He found the Internet a great tool in finding articles because he felt the library doesn’t have a lot of resources. They could go on JSTOR (Journal Storage) for history and find useful websites for teaching Canadian

history. The networking involved with the other preservice teachers in the class was beneficial.

Fran, being in the Primary Junior division, did not have a teachable subject but found her Math professor frequently used different software, such as sketchpad and Tinkerplot. On his website, he has a matrix of many websites as a resource for teaching Math. Fran lamented that she does not remember how to use them all because he went too fast in class. She indicated it would be helpful for the professor to spend quality time on a few software programs rather than trying to show them all. This was one example of the need for more time required to learn technology in the limited course hours available.

Sabrina stated that she was taught to know about many practical ICT tools and would like to explore them a little more in a classroom setting; however, access to the computer lab was not always available for 35 students while teaching during the practicum. The limited resources of schools sometimes restricted the authentic use of ICT integration for preservice teachers.

George stated that, in his Math class, they were taught a research lesson using Statistics Canada's EStat, which involved creating a write up with graphics. He was able to incorporate this experience into a grade 8 lesson during his placement. They utilized a computer program called Quattro Pro 12, which involved data management where the students had to create bar graphs. It was the integration of graphing, data management and ICT in one lesson. This is an example of an ICT integration lesson modeled by faculty and then being used by preservice teachers in the practicum. Depending on the ICT infrastructure available in the schools, some preservice teachers were able to practice ICT integration where others could not.

Cam found that his ICT integration experience was good for established technologies, but there was still more to learn in integrating ICT into teaching.

> Well in general, I found a really good use of technology that's been established for a long time like DVD, VCR, and PowerPoint, which we all learned how to use thoroughly this year. The emerging technologies I found weren't all that prevalent this year, like using blogs, stuff like that, the Internet based learning. Some of the professors had good websites, but we weren't really shown how to set up those websites all that well to use them in our own classrooms. But beyond that, we didn't learn much about emerging technologies, I thought. (Cam, 2007, interview)

One of the Intermediate /Senior preservice teachers found that if their elective professor was employed part time, then there was less technology used in their classroom:

> I found that most professors really knew how to use the equipment, which was good. But those professors who weren't really full time [university] faculty members, I found they had a lot more difficulty using it (ICT) and didn't use it at all in their classrooms. (Mary, 2007, interview)

Lynn found that most of the professors in Primary Junior often used PowerPoint in their lesson and could be obtained by either email or downloading from the professor's website. She felt she did not have to listen in class if she had access to the PowerPoint presentations. She did go to the Technology conference put on by Josephine in January. At the conference, she saw some very interesting material that was available online where they could all work on the same document at the same time.

On learning what kinds of ICT integration they had learned, Mary mentioned the Ontario Curriculum Unit Planner (OCUP). She learned how to use it but she did not find the program effective for herself. They were forced to use it and would have preferred an opportunity to try other software planning packages. Cam, in contrast to Mary, loved the OCUP and went to a couple of seminars on the planner with his associate teacher on a placement. With the extra time on the planner on the placement, he was amazed at how well he was able to use it. This is an example of one person making the decision to adopt and another choosing not to adopt the innovation.

Cam stated that much of the ICT material was covered in passing and they did not get an opportunity to master any of the software. Sometimes it was just a footnote at the bottom of a PowerPoint. He said he rarely checked out the recommended websites.

Results from the survey and the interviews indicate the preservice teachers in the B.Ed. program are provided with varying degrees of ICT integration by faculty in their courses. In addition, they also receive; twelve hours of Computer course instruction taught throughout the year by a faculty member twelve hours of orientation workshops with the laptop at the beginning of the year prior to classes starting, and additional opportunities to attend workshops and a technology conference during the school year.

Faculty members have adopted a wide variety of technological innovations and are using ICT skills in planning, implementation, assessment, communication with

preservice teachers and integration into their teaching. ICT is not often used with special needs. ICT is being integrated into teaching through classroom teaching, use of software, with the professors having at least one assignment integrating technology. B.Ed. graduate teachers comments support the faculty survey; however indicate there were some faculty members who did not utilize the laptop in their teaching.

### 4.4 Adoption of innovations

An innovation would be considered adopted when a faculty member chooses to integrate a specific tool into their teaching. They would normally go through the innovative-decision making process of: 1) knowledge, 2) persuasion, 3) decision, 4) implementation, and 5) confirmation prior to fully adopting or integrating the tool into their teaching (Rogers, 2003).

The attributes of the innovation influence the decision making process and the rate of adoption. The five attributes include: relative advantage, compatibility, complexity, trialability, and observability (Rogers, 2003). The laptop was adopted by the university in 2002, and can be considered a technology cluster, however each individual application on the computer would follow the decision making process prior to being integrated within a professor's teaching. The attributes of each of the innovations will determine its rate of adoption.

The faculty must consider the relative advantages of adopting the innovation to determine if the expected benefits outweigh the costs. One cost is the time required to learn the complex ICT tools which thus becomes a factor in the decision making process. During the confirmation stage, an innovation must be considered sufficiently worthwhile or practical for classroom use, and then determining strategies to integrate the tool into teaching. Ideally, the faculty members would learn the ICT tools and skills prior to teaching the preservice teachers. Such learning can be considered part of the adoption process. Eventually if adoption occurs, fluency develops in using the ICT teaching tools, enabling greater use and creativity with the tools (Urbain-Lurain, 2000).

Many faculty members would have use of computers for some time prior to the Faculty of Education adopting the laptop in 2002. However it was important to determine if ICT learning was occurring once they were teaching at the university. If it can be established that ICT learning was occurring, it then could be determined how this process

happened. The faculty rated their skill level in various ICT tools prior to coming to teach at the university compared to the time the survey was taken, as shown in Table 5.

The computer itself is a tool yet there are many ICT tools (software applications) within the computer that can be used in different ways as teaching tools. However, many of the older teaching tools, (non ICT tools) would still be taught to the preservice teachers as they are still valuable and necessary within the classroom. It could be assumed that the more teaching tools that a preservice teacher has, the better prepared they are for teaching in the classroom.

Faculty members bring previous ICT skills from their own teaching experiences and continue to learn once they are teaching at the faculty. The overall mean was calculated to determine if there was an overall increase in ICT skills, suggesting learning had occurred. The faculty rated their expertise on ICT skills prior to coming to the university with an overall mean of 2.543 for 19 different ICT skills (see Table 5) and since they have been working at the university, the mean for their expertise is now 3.217. This increase in every area of ICT reflects not only their perceived learning since arriving at the university, but also the learning of new recently developed technologies. The survey indicates that faculty had increased their expertise in ICT skills since they have taught in the laptop program.

The degree of reliability of the measures in Table 5: Ranking of perceived ICT skills of faculty, were determined using SPSS 15. The Cronbach's alpha for the 19 perceived ICT skills prior to working at the university was 0.826, while the value for the ICT skills ranked at the time the survey was 0.875. This high Cronbach's alpha value is a good indication of internal consistency of the test where any value above 0.7 would be considered reliable (Gall, Gall, & Borg, 2005). A paired sample t-test between the means of prior and present perceived ICT skills differed significantly, $t_{18} = -12.603$, $p < .001$. This statistical evidence is a strong indication that perceived ICT skills are being learned by faculty.

**Table 5:**
**Ranking of Perceived ICT Skills of Faculty**

| | ICT Skill | Count | Prior Mean | Present Mean |
|---|---|---|---|---|
| 1. | Email | 39 | 3.923 | 4.500 |
| 2. | Word Processing (i.e., MSWord, WordPerfect) | 38 | 3.824 | 4.222 |
| 3. | Internet to retrieve information | 39 | 3.615 | 4.486 |
| 4. | Keyboarding | 39 | 3.538 | 4.108 |
| 5. | Internet to retrieve research articles | 38 | 3.500 | 4.333 |
| 6. | Storage of data on CD | 39 | 3.103 | 4.216 |
| 7. | Presentation software (i.e., PowerPoint) | 39 | 2.949 | 3.946 |
| 8. | Spreadsheets (i.e., Excel) | 39 | 2.487 | 3.189 |
| 9. | Multi-media presentations | 39 | 2.436 | 3.054 |
| 10. | Course related software programs | 39 | 2.333 | 3.324 |
| 11. | Desktop publishing (i.e. MS Publisher) | 39 | 2.154 | 2.730 |
| 12. | Synchronous chat (i.e., MSN, Yahoo) | 39 | 2.077 | 2.486 |
| 13. | Online course development | 38 | 2.053 | 2.806 |
| 14. | Graphics software (i.e., CorelDraw) | 39 | 2.051 | 2.351 |
| 15. | Webquests | 39 | 1.821 | 2.189 |
| 16. | Website development | 39 | 1.744 | 2.649 |
| 17. | WebCT course development (or similar program) | 37 | 1.718 | 2.486 |
| 18. | GPS | 39 | 1.513 | 2.081 |
| 19. | Smartboard | 39 | 1.462 | 1.973 |
| | | Average | 2.543 | 3.217 |

Additional data from the survey indicated the top seven ICT skills they have integrated into their teaching are the same skills that they have the most proficiency. The following is the ranking of the top seven ICT skills that are integrated into their teaching; 1) use of Internet to retrieve information, 2) use of PowerPoint, 3) word processing,4) use of Internet to retrieve research articles, 5) use of email, 6) storage of data on a CD, and 7) keyboarding. This is an indication that professors integrate ICT skills that they have learned. The ranking of the rest of the ICT skills did not correspond to the learned skills.

Although many faculty members did not integrate various ICT skills within their teaching, this did not always mean the preservice teachers were satisfied with the amount of ICT integration. The B.Ed. graduates indicated their desire for more time to learn course related software programs, more time with evaluation software (spreadsheets), website development and the Smartboard.

Online delivery was used by 42% of the faculty in part of their course delivery. This would include the use of WebCT and the access of information through faculty websites. The use of the GPS would be course specific, such as Geography or Outdoor

Education. Synchronous chat was listed as a skill that some faculty learned. Although it was listed low as an integrated ICT skill into teaching, it was used frequently enough in the classroom by preservice teachers to become a behavior management concern according to both faculty and preservice teachers.

### 4.4.1 The faculty learning process

There was no single method of learning ICT skills, although faculty used some methods more than others. Table 6 summarizes the data taken from the online survey on how the faculty have learned their ICT skills followed by the count (number of responses), mean score (in brackets) derived from a Likert scale out of 5, selected from the choices of: Never, Rarely, Sometimes, Often, and Very Often. Generally, ICT is well used in the following areas: preparation (4.75), implementation (4.47), assessment (4.44), communication with preservice teachers (4.40), and classroom use (4.19). The lower score for assistive technology (2.62) may be smaller as not all professors had special needs students in their class. (Choices were on a Likert scale; Never, Rarely, Sometimes, Often and Very Often). Most of the faculty learned the skills on their own, 3.973 and from colleagues, 3.676. The next three methods of ICT learning come from the assistant, Josephine, 2.919, the Student Technical Assistants (STAs), 2.838 and University Technical Support (UTS) 2.75. The following methods of learning are used less frequently: faculty development workshops, 2.568, students (preservice teachers), 2.514, computer courses, 2.333, school board professional development, 2.222, conferences, 1.784, and the lowest was the associate teacher at 1.297.

Many faculty members do not supervise preservice teachers in their practicum and would not be in contact with associate teachers which may explain the low score. However, it could indicate the lack of partnerships or the lack of ICT expertise of teachers in the field.

**Table 6:**
**How Faculty Learn Their ICT Skills**

| | Method | Count | Score |
|---|---|---|---|
| 1. | Self taught | 37 | 3.973 |
| 2. | Colleagues | 37 | 3.676 |
| 3. | Technical Assistant | 37 | 2.919 |
| 4. | Student Technical Assistants (STAs) | 37 | 2.838 |
| 5. | Technical Support (UTS) | 36 | 2.750 |
| 6. | Faculty development workshops (at the university) | 37 | 2.568 |
| 7. | Preservice teachers (not STAs) | 37 | 2.514 |
| 8. | Computer courses | 36 | 2.333 |
| 9. | Other | 26 | 2.231 |
| 10. | School board professional development workshops (other than the university) | 36 | 2.222 |
| 11. | Conferences | 37 | 1.784 |
| 12. | Associate teachers | 37 | 1.297 |

A further examination of the survey data uncovered that faculty development was a weak method of learning ICT. Out of 37 faculty members, never 7 or 19% never, 9 or 28% rarely, and 15 or 41% sometimes learned ICT through faculty development. Only 5 or 14% often and 1 or 3% very often learned through faculty development. These low scores indicate if effective ICT integration requires faculty development (UNESCO, 2008), then this is a concern at the University. Table 7 illustrates the frequency analysis of all faculty members who have learned their ICT skills through faculty development at the university.

**Table 7:**
**Faculty Who Have Learned ICT Through Faculty Development**

| Answer | Count | Percent |
|---|---|---|
| Never | 7 | 18.92% |
| Rarely | 9 | 24.32% |
| Sometimes | 15 | 40.54% |
| Often | 5 | 13.51% |
| Very often | 1 | 2.70% |
| Total | 37 | 100% |

When faculty were asked in the survey to rate the faculty development initiatives at the university regarding information, 5.71% thought they need improvement, 5.71% felt they were weak, 28.57%, felt they were fair, the majority, 45.71% thought they were good and 14.29% felt they were excellent. Faculty development is not the primary

method of learning ICT at university although the survey results indicate that 45.71% thought faculty development initiatives were good and 14.29% felt they were excellent.

In implementing ICT into education, the UNESCO (2002) document recommends that teachers need effective professional development (Brown & Pettito, 2003; Resta, 2004). One of the most common concerns of teachers and faculty have in learning how to integrate ICT, is the lack of professional or faculty development (Thompson et al., 2003) and was mentioned in previous studies at the university (Stewart, 2003).

Kevin, the faculty member who has been in charge of ICT for two years and sometimes provides faculty development workshops, was asked how many faculty development workshops have been given and how well they were attended:

> My first year we gave a couple (of workshops) during the regular year and then we gave a couple in the spring session on ABQ courses…subsequent to that, fewer…I think we've given two during the regular school year and tried to offer one in the ABQ session. And the participation rate was better for Arts and Science than Education. We would get somewhere in the range of 10-12 people, so not a lot. (Kevin, 2007, interview)

This attendance at workshops was common with Ellis (2004) who found that small workshops and brown bag sessions were poorly attended. If only two faculty development workshops are given a year, and more Arts and Science faculty attend rather than Education faculty, this would mean that less than six Education professors attend about two faculty development workshops a year. Guskey (2000) states that, when professional development occurs only 3-4 days a year, an educator's opportunity to learn is restricted. Such a finding would suggest that most professors are learning about ICT somewhere else.

Most professors learned ICT on their own as indicated be a value of 3.973 on a Likert scale of 1 to 5. Table 8 describes the frequency of faculty that state they are self-taught in learning how to integrate ICT into their teaching. The majority of faculty, 37.84 % chose very often, 29.73 % chose often, 27.03% chose sometimes, and 2.7% chose rarely and never.

**Table 8:**
**The Number of Faculty Who Are Self-Taught**

| Answer | Count | Percent |
|---|---|---|
| Never | 1 | 2.70% |
| Rarely | 1 | 2.70% |
| Sometimes | 10 | 27.03% |
| Often | 11 | 29.73% |
| Very often | 14 | 37.84% |
| Total | 37 | 100% |

Learning how to integrate ICT into teaching would also include factors related to self-confidence, self-efficacy, and reported skill in the use of ICT (Brinkerhoff, 2006). Faculty were asked to rate themselves according to the Apple Classrooms of Tomorrow (ACoT) scale on their level of confidence in, and skill with regard to, ICT as described in Table 9. Faculty ranged from adoption 13.89%, adaption 41.67%, appropriation 36.11%, to invention 8.33%, with the majority of the sample falling within the adoption and appropriation stages.

Both Grossman (1999) and the CEO Forum on Education (2000) have the fifth stage as a mastery or inventive level. The creativity achieved comes with the fluency with the tool (CEO Forum on Education and Technology, 2000).

With the laptop program starting in 2002, it has taken over five years (although some faculty have been hired within the last five years), for very few professors (3) to have reached the invention stage in confidence and skill in ICT use. However, not all educators have full confidence in using the laptop, indicating that mastery of this tool does take time (UNESCO, 2002). Table 9 indicates the self-ranking of ICT confidence and skill according to ACoT, with the count indicating the number of faculty who responded to this question. There were no faculty who participated in the survey at the entry stage, 5% were at the adoption stage, 15% were at the adaption stage, 13 % at the appropriation stage, and 8% at the inventive stage.

**Table 9:**
**Faculty Self-Ranking of ICT Confidence and Skill According to ACoT**

| Answer | Count | Percent |
|---|---|---|
| **Entry Stage**: Educators struggle to learn the basics of using technology | 0 | 0.00% |
| **Adoption Stage**: Educators move from the initial struggles to successful use in technology on a basic level | 5 | 13.89% |
| **Adaption Stage**: Educators move from the basic use of technology to discovery of its potential for increased productivity. | 15 | 41.67% |
| **Appropriation Stage**: Having achieved mastery over technology, educators use it effortlessly as a tool to accomplish a variety of instructional and management goals. | 13 | 36.11% |
| **Invention Stage**: Educators are prepared to develop entirely new learning environments that utilize technology as a flexible teaching and learning tool. They begin to think with the technology, designing new ways to solve learning problems that their students may have faced in the past. | 3 | 8.33% |
| Total | 36 | 100% |

### 4.4.2 B.Ed. faculty comments on learning ICT

The interviewed faculty described how they are learning to integrate ICT into their teaching. The comments support the findings from the survey responses in that most of the faculty members are learning on their own or from colleagues. Overall, there is a lack of formal, regular faculty development in this area.

The following examples illustrate fairly typical methods faculty engage in ICT learning. Irene, who has taught at the university for five years, feels she has mainly learned the ICT technology on her own or in collaboration from colleagues. She learns on a need to know basis and over the years has collaborated with about 6-8 colleagues in learning ICT. Presently, more colleagues come to her for help in ICT rather than her approaching others. Some ICT skills she has taught her colleagues include formatting a dissertation, how to incorporate pictures into a PowerPoint, how to add sound, and how to hyperlink.

In terms of faculty development in technology, she has not had any faculty development since the orientation session when she was first hired. She states that this initial workshop included ICT skills such as connecting to the Internet, how to save on a CD, and how to use the data projector. Irene has had the Educational Technician

Assistant, Josephine, in her class to give workshops on Storybook Weaver in the past but now prefers to teach it herself. She does not go to Josephine for help with ICT.

Karon has participated in only two faculty development workshops of about three hours in length, one when she was initially hired at the point when she was given her laptop. This workshop involved having a faculty member who teaches computing demonstrate the different software packages on the computer. The second workshop was a three hour Dreamweaver workshop where she was taught how to create a webpage, but she initially believed the workshop was supposed to be on how to post to her webpage.

Karon having taught at the university for only two years, has recent experience in the classroom and has learned ICT skills on her own. She looks through scientific catalogues in order to purchase new technology such as graphing calculators, scientific software such as Logger Pro and the physics probeware Xplore package by Pasco. Additionally, Karon often discusses teaching strategies involving ICT with her colleagues.

Kevin has also learned most of his ICT skills on his own. He has participated in about 6 to 10 ICT workshops in his time at the university, which includes some off campus workshops. There was a number of other off campus workshops that he would have like to have attended but could not due to travel costs.

Joan has learned most of her ICT skills on her own, and most of these while she was a teacher in the field. Joan has had no faculty development in ICT in all of the five years she has worked at the university. There have been a few workshops that she was interested in but there was a teaching or other work-related time conflict at these times. Joan has had Josephine (technical assistant) in as a guest speaker to teach her students how to use Markbook, an assessment software and she continued to come in regularly into the classroom in 2006 - 2007.

Donny has learned from colleagues and regularly meets and shares his work, such as PowerPoint presentations, or helpful websites with other Methods professors. He has had Kevin, the Computer professor, teach his class how to use the electronic report card and Kevin has helped Donny in the use of Excel for calculating preservice teacher marks. He has had Josephine come in to his class and teach the preservice teachers about Ontario Curriculum Unit Planner (OCUP). He mentions that when he was at OISE/UT he took a

10 week course on how to research using Google and ProQuest. He has not attended many in-servicing or workshops on faculty development as he tends to lose interest in any workshop presentations on new technology:

> A couple of times we've had somebody stand up and drone on. Personally if I'm going to be presented with new technology, I'd like to have a ten or fifteen minute introduction. If it's going to be forty minutes I'm going to lose interest. We have been very limited in terms of in-servicing. (Donny, 2007, interview)

Brenda has attended a few workshops on ICT. Initially she attended one on how to use the Internet. She would prefer that a workshop be followed up with coaching. She learns ICT from colleagues, from Josephine, from University Technical Services (UTS) and from the Student Technical Assistants (STAs).

Aimee has learned on her own, from her colleagues, Jim (Director of Instruction), her students, and UTS. She had no ICT training or workshops prior to teaching at the university but did attend some during this past year. She wanted to attend some of the student workshops at the beginning of the year but many did not fit her schedule. She did attend a Smartboard workshop but found she did not learn enough in one setting to be able to use it in her classes. She found some packaged programs on Smartboard that used activities which would probably work just as well using an overhead so she was unimpressed by that particular technology. She did attend two 45 minute workshops regarding our new computers which have Windows Vista and Office 2007. She has some concerns about using the new software:

> I'm a little leery because I don't have a lot of general knowledge of how to do things, just little things and I just wonder if I might be getting myself into more difficulty when I read and I don't have the time to clown around. It may seem silly but I don't have time to wonder what kind of box it will create for me, just to get my work done. But I just can't learn technology in one session, it's a whole new world to me. (Aimee, 2007, interview)

One of the challenges that Aimee faced started at the beginning in her preparation for the job interview at the university. She was asked to present using PowerPoint and she had not used this software before. She had worked in the school board for a number of years as a principal and had enough ICT knowledge to do her job but had not taken extra courses in ICT or how to integrate ICT into teaching. When she started at the university, she had to learn how to set up a website because everybody had a website. Jim came in

and assisted with her website setup. Aimee also found the preservice teachers quite helpful in getting her set up in her classroom teaching with ICT while teaching in the Faculty of Education.

> I used videos, and 'you learn by doing' seems to be my thing in life. If I want to find out something, I just have to try to find it out for myself. Like the day I wanted to show a video in one of the rooms and there wasn't a television set up there. So I'm hunting around finally find one in a little seminar room and pull it into my room where I was teaching and start to hook it up. One of the kind students [preservice teachers] came to my rescue and said 'Oh, do you want to show a video?' and I said 'Yes but there's no TV screen,' and she said 'Oh you don't even need that.' So she showed me how the VCR is connected to the projector on the big screen so again that's how I learned, through that kind of thing. Often if there was a glitch or problem with my laptop in projecting whatever I needed to in class I would just say 'Help' and some kind student would come to my aid and show me what to do. So that's been great having the students [preservice teachers] always willing to help me. (Aimee, 2007, interview)

The following are some of the anonymous comments of the faculty from the online survey regarding faculty development and how professors are learning ICT at the university. This faculty member describes in the following excerpt how she would like to have ongoing faculty development and that she learns ICT skills from colleagues, family, and friends.

> I would be interested in attending ongoing professional development sessions for Faculty if these were offered in various areas addressed by this survey (e.g., integrating technology, uses of software etc.) Currently, there doesn't seem to be very much actual support available on an ongoing basis. Thank goodness for colleagues, family and friends! (Faculty survey, 2007)

This faculty member has gained confidence in the use of ICT over the time he or she has been at the university which is important in being able to teach using ICT. The faculty member utilized the Director of Instruction, Jim and the technical assistant Josephine, and found one-on-one training was more effective than a large workshop setting.

> Gaining confidence has allowed me to 'experiment' with new strategies. In year one, a colleague met with me weekly to set up my own website using Front Page. I subsequently created my own website and each year post to it. I have felt some success in doing so. Each year when given a new image or laptop, I have to set up features. This year for the first time, I was able to set up my dial-up for the computer off site. Jim and Josephine have been readily available to assist and

> answer any question, no matter how small. This has been very helpful to me over the past three years. I must learn by doing and large classroom workshops aren't always helpful for me. One-on-one is best for me. (Faculty survey, 2007)

The following faculty member comments on the frustration of using ICT and the lack of faculty development they have experienced. Concern was expressed over the only integrated use of ICT in some B.Ed. classrooms which consisted of only using PowerPoint and a website. The concern of classroom management with laptops was raised. They suggested that faculty could learn from observing schools in the field that have a ubiquitous laptop program.

> Having been a member of the staff during teaching time, I have witnessed the frustration faculty and students have shown concerning technology. Not once during the four years that I have been at [the university] have instructors been taught how to properly use the laptops in a class. There are schools [school names removed] that are laptop schools. Laptops seem to only be used to show PowerPoints and to post notes. With an aging faculty that perhaps do not know how to integrate technology properly, classroom management can become an issue. Observation of laptop schools [school names removed] may be helpful for the faculty at [the university] to learn from. (Faculty survey, 2007)

The overall suggestion from the faculty survey was that faculty require, “Regular, on-going faculty in-service of ways and means to use and increase the use of ICT in teaching” (Faculty survey, 2007)

Jim, the Director of Instruction, conducted ICT workshops in small group settings. However he found the most efficient way was one-on-one with professors in their own setting. He felt that professors are more willing to admit that they need help in one area in a one-on-one situation rather than be embarrassed about not knowing something in a group setting. There were about 165 professors at the university including the Arts and Science Faculty and he worked with about 65 who want to learn about technology. Of the approximately 50 professors who taught in Education, Jim worked with about 25. The main technical work he does with the professors is assisting them with their website. He provided support to faculty who wanted to work with the webpage creation software Dreamweaver and FrontPage.

Kevin as the laptop coordinator was involved in setting up faculty development. He found it disappointing that there were not more formal recognition as an expectation for the faculty to attend ICT workshops. When a workshop was offered, there was often

low attendance. He would have liked to set up something on a more regular basis so that faculty would have the opportunity to participate. He thought that, because of the sporadic nature of the faculty development, people seemed to miss a workshop when it comes up. He has been frustrated at the lack of participation in some initiatives that he has started, such as visits to schools that have laptop programs.

Since Kevin was the coordinator of the laptop program some of his comments in the interview went into more depth than expected from other faculty. He stated that some of the best faculty development was what he called “just in time” assistance. When someone had a need or a problem, they want a solution right away. This technique has been used commonly as a faculty development tool in other universities (Brown & Pettito, 2003; Stewart, 2003; Wicker & Boyd, 2003; Thompson, Schmidt, & Davis, 2003). He felt this was an effective method of assistance and many faculty members have asked him for one-on-one help with a particular program such as Markbook.

Kevin felt the larger group work shop sessions were effective and there was positive feedback but there was no follow up. The faculty members had an opportunity to attempt something new, such as loading a webpage. Afterwards being alone at home, they experienced difficulties with no one available to assist them. This indicated that frequency and practice are needed to learn ICT skills to gain fluency as suggested by Urbain-Lurain, (2000). The professional development opportunities were sporadic and there was too much time in between sessions, frequently the faculty forgot how to use the technology, requiring Kevin to start from scratch again.

Regular once a month informal gatherings for professional development that would generate some technology conversations was something that Kevin would like faculty to experience. He found that the sessions were so rare now that when people do have a conversation it was usually about something negative, such as the email going down or Webadvisor was down. He felt that the most rewarding professional development experiences were when people generated more positive conversations rather than confrontational conversations. He used an example of when he was giving an ICT report at a divisional meeting where people complained about preservice teachers using MSN in the classroom. Many faculty members joined in to complain about MSN and the majority of the time was spent on this negative aspect of ICT when the time could have

been spent on something positive such as a successful teaching experience someone was doing in their classroom or sharing what someone learned at a conference.

The Dean felt that one of the challenges in implementing the laptop computing program is the faculty turnover. Sometimes faculty leave, take sabbatical or retire and they must be replaced. The number of faculty has grown over the years as well because of the growth in numbers of B.Ed. preservice teachers that have been accepted into the program. He stated that the new professors had to be in-serviced over a 2-3 year period to be effective at integrating ICT. There was a lot of time spent initially when the laptop program began in differentiated staff training and workshops. The recently hired professors had not gone through the same thought process as those professors that have been here since the beginning. He states that many new professors do not have the same commitment to ICT integration because they did not choose the innovation, rather they were forced or expected to use it.

> The trouble is now we are bringing in people that are just starting in the program, brand new professors. They never went through the thought process that we did of selecting the innovation. They don't have the same commitment because they didn't choose the innovation. They came here because they wanted a job and it just happened to come with the job. We find ourselves quite often discussing things that have been dealt with six or seven years ago. Now we have new people but they are raising new objections because they were not here at that point, so we have to go back and we have to try to provide workshops and support for those people. We've been doing this for seven years and they're coming in cold. It's really hard to get them to be committed to the integrating of ICT. (Dean, 2007, interview)

The Dean stated that many of the people are working in an interim position and might not see themselves teaching at the university for the long run. He acknowledged that faculty members had a wide variation in degrees of integration of ICT skills. He felt that some faculty told the preservice teachers much too often to close their laptops. He agreed there are times to close the laptops but some faculty are not integrating technology at all and that will not be acceptable in the long run. The Dean stated, "So that's a challenge, I've got people at a variety of different skill levels and I've got people at different levels in terms of attitudes of adaptivity and in terms of integration." (Dean, 2007, interview).

### 4.4.3 B.Ed. graduates comment on faculty ICT teaching

Stephanie, a preservice teacher recognized and accepts that the professors have varying degrees of knowledge and skill regarding ICT but believed they should have some faculty development. She suggested workshops that would educate the professors in basic ICT skills prior to their teaching in the B.Ed. program, would be of benefit to the preservice teachers.

> The other thing would be, knowing all the professors have different levels of knowledge. I think one thing they should do is have a refresher course or something that updates all the professors so they all have the same baseline of knowledge at the beginning. They should have professor workshops or something before they start teaching. If they're going to teach us about technology I don't see why they're not having a workshop on something. They're going to be teaching us all year and I found some of the profs for example, did use technology a lot, but then there were also professors that didn't know how to use the technology. If they were doing a PowerPoint presentation they didn't even know how to upload it to their site, so they had a lot of problems with their websites. They had people doing their websites for them but then those people weren't reliable so they always had excuses why they didn't have things accessible to us. So that's why I think they should have workshops. (Stephanie, 2007, interview)

Fran stated that she did not learn well from a manual and preferred to have someone teach her how to learn software. She felt, "If you are going to offer a laptop program then the professors should know how to use the software programs because as a learner, one needs that support." (Fran, 2007, interview). This comment indicates a need for the faculty to know how to use the software if they are going to integrate ICT into their teaching.

## 4.5 Organizational support

People who use the communication channels within an organization are considered the social capital. Diffusion of innovations is influenced by this communication with others and in fact their perceptions drive the implementation. The informal access to expertise and responses to social pressures are manifestations of social capital (Frank, Zhao, & Borman, 2004). Faculty members' adoption of an innovation would be influenced by people in their professional environment, particularly those members of the community who work directly or indirectly in the education of preservice teachers. This would include people who were in a support capacity such as the technicians, and in an administrative position, who had the power to make decisions on

organizational structures and allocation of resources and colleagues of faculty. The external systems of government, schools and professional organizations would also be a part of the professional environment.

Wenger (2005) describes communities of practice as an effective method on how groups of people learn together. A community of practice is formed by people who engage in a process of collective learning in a shared domain of human endeavour. "Communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly." (Wenger, 2005).

The professional environment of the faculty can affect the practices of the integration of ICT into their teaching. The faculty members are learning about ICT and the integration of ICT into teaching primarily on their own and from colleagues. This can be considered a learning community where the environment and culture of an organization is developed by the people who communicate with each other (Wenger, 1991). These communication channels are part of the social capital (Frank, Zhao, & Borman, 2004).

Learning can occur in communication with others (Rogers, 2003). Table 10 indicates the frequency of who faculty are communicating with in regards to ICT integration, listing various groups, followed by the count (number of responses), and mean score (in brackets) derived from a Likert scale out of 5, selected from the choices of: Never, Rarely, Sometimes, Often, and Very Often. Most faculty discussed ICT integration with other colleagues with a mean of (3.5), then colleagues who teach computers, (3.314), equally as much as students, (3.314), family or friends, (3.278), than colleagues who are outside the Faculty of Education. The interaction with the technology assistant at (2.857) was slightly higher than the STA's at (2.194) and very little discussion occurred with administration, (2.139).

**Table 10:**
**With Whom Faculty Discuss ICT Integration**

| | Question | Count | Mean |
|---|---|---|---|
| 1. | Colleagues | 36 | 3.500 |
| 2. | Colleagues who teach computers | 35 | 3.314 |
| 3. | Preservice Teachers | 35 | 3.314 |
| 4. | Family or friends | 36 | 3.278 |
| 5. | Colleagues outside the Faculty of Education | 36 | 2.861 |
| 6. | Technology Assistant (Josephine) | 35 | 2.857 |
| 7. | Student Technology Assistant(STA) | 36 | 2.528 |
| 8. | Teachers in the field | 36 | 2.194 |
| 9. | Administration | 36 | 2.139 |

In the discussion of ICT, colleagues were the most frequent contact with a mean of 3.5, but how frequent did colleagues communicate with each other regarding ICT? One colleague never and two others rarely discussed ICT with anyone, which is approximately 8% of the faculty who took the survey. It would be worthwhile to determine why some people were not communicating with others regarding ICT, if this is second most common methods of learning about ICT after self learning. The majority, 47.22% sometimes discuss ICT with colleagues then 27.78 % speak often while 16.67% very often speak with their colleagues. Table 11 indicates how frequently faculty members communicate with colleagues in regards to strategies of integrating ICT.

In interviews with members of the community, the technical support resource people, Josephine and Jim, state that the interaction with the faculty was addressed which can be considered part of their responsibilities of their job.

**Table 11:**
**Frequency of Faculty Discussing ICT with Colleagues**

| Answer | Count | Percent |
|---|---|---|
| Never | 1 | 2.78% |
| Rarely | 2 | 5.56% |
| Sometimes | 17 | 47.22% |
| Often | 10 | 27.78% |
| Very often | 6 | 16.67% |
| Total | 36 | 100% |

Table 12 illustrates the frequency that faculty discussed ICT least with administration, at a mean of 2.139. Most faculty, 26 out of 37 respondents never (N=9) or rarely (N=17) discussed ICT with administration. Only 2 spoke very often with administration about ICT. There may be a number of reasons for this low frequency and

proper analysis could only be determined if further questions probed into the nature of faculty / administration conversations or relationships. On faculty there is an ICT coordinator who would frequently discuss laptop issues with administration.

**Table 12:**
**Frequency of Faculty Discussing ICT With Administration**

| Answer | Count | Percent |
|---|---|---|
| Never | 9 | 25.00% |
| Rarely | 17 | 47.22% |
| Sometimes | 8 | 22.22% |
| Often | 0 | 0.00% |
| Very often | 2 | 5.56% |
| Total | 36 | 100% |

The Dean described some of the historical implementation process that has occurred and discussions he has had with other groups. He has communicated with the Ontario Ministry of Education on attempts to solve some issues regarding licensed software rights. He also communicates with upper administration on resources, the technical support area on infrastructure such as classroom setup and wireless.

### 4.5.1 Technical support

The complexity of some ICT can be simplified through technical support. The professional community includes faculty colleagues as well as Josephine and Jim. both of whom provided technical support for preservice teachers and faculty respectively. Although Student Technical Assistants (STAs) were preservice teachers, they were also hired to assist in some faculty and preservice teacher learning of ICT.

In describing her role and responsibility, Josephine stated that she has been working as technical assistant within the Faculty of Education for 4 years. She is 30 years old and was a B.Ed. graduate of the laptop program 4 years ago and was currently working on her Masters of Education at the university. Her role is to support the students in ICT within the ITeach program. On average she would interact with about 50-100 students, and 2-3 faculty during the day.

Some of her duties included helping students with software such as the OCUP, organizing extra ICT workshops, organizing the ICT conference in January, and helping in preparation. She considers her job to be finding, creating, organizing and attaining resources for the preservice teachers and faculty to learn how to use technology. She did

not work on repairing hardware related issues but directed students to UTS who encountered computer hardware problems.

She was involved in hiring about 30 -35 Student Technical Assistants, (STAs) who were preservice teachers hired to assist their classmates regarding ICT. Josephine, trains the STAs on different topics including the software that is used in the B.Ed. program including the OCUP, how to use the wireless on the laptops, Office 2007, trouble shooting the new operating system Windows Vista, and report cards. Although Josephine often assisted faculty, she has never formally taught faculty development regarding ICT, it has always been a preservice teacher focus. Some of the areas in ICT where faculty have asked for her assistance included website development, PowerPoint, software such as OCUP or Markbook, and minor emergencies such as when a data projector was not working.

Josephine was asked if she was aware of Jim's (Director of Instruction) role at the university and she was not familiar with his role. There appears to be a lack of communication between these two people who both assist in the instruction of ICT although in different capacities at the university. Jim is utilized more with Faculty, predominately Arts and Science, and Josephine works with students and sometimes faculty in the B.Ed. program.

Josephine was asked if she was aware of some of the assignments that preservice teachers have that involve integration of ICT. She stated that a common one is the planning of a unit using the OCUP, creating a brochure using Publisher about a particular theorist in education, the use of GPS units in Outdoor Education and Geography, using Geometer's sketchpad in Math, assessing software in music, and assessing and comparing software in Special Education, such as Kursweil, Co-writer, or Write Out Loud. In the Computer course, the preservice teachers were required to create a website, create electronic report cards in Markbook, Teacher's Partner, participate in an online technology inventory, create videos of themselves in movie maker and the digital video cameras, assess websites, Kidpix, and webquests. Joanne was familiar with the ISTE standards.

When asked if the faculty ever asked her about how to integrate technology into their teaching, she said, "Rarely". If they come to her, it is usually with a specific

question about technology. She has been asked to teach lessons within a professor's class, primarily OCUP and occasionally other software packages.

When asked where she learns about her ICT Josephine mentions her father who taught at a technology school in Ontario. This school received a huge amount of money to buy technology so it was a model school for technology. She has learned from her spouse who was a network administrator for a while. She did not have any courses in computers other than the 12 hours she received in her B.Ed. at the university and in the other courses where ICT was integrated. She has attended some conferences that have included workshops, but the teaching was more of an exposure of what can be done with this software rather than a "hands on" experience. She had recently taken some online courses. Most of what she has learned has been on her own:

> When I learn about ICT, 99% of the time it is self taught. It is partially because of the nature of my job and partially because of the style of learning that I prefer. Say I want to learn a piece of software, I'm more inclined to just sit in my office, install that piece of software, open it, and play with it until it does what I want it to do or figure out what it can do for me. The vast majority of the time I am self taught. (Josephine, 2007, interview)

Jim has many years of experience in education. He started teaching in 1962 and taught in the Faculty of Education from 1984 to 2000. Rather than retire, Jim was offered the position of Director of Instruction where he has worked alone for the past six years. He assisted both Arts and Science and Education faculty with websites and preparing PowerPoint presentations. He hoped to expand his area over the next five years put more emphasis on teaching and teaching with technology. He hoped to support all faculty, first from a traditional teaching perspective and then from a technology perspective. Over time he has gone initially from about 90% traditional support and 10 % technology to presently about 20% traditional support and 80% technology support. Jim was asked if he was familiar with the ISTE NETS (2004) and he was not. After reviewing the standards he was confident that the university was covering the standards.

The student technical assistants (STAs) are preservice teachers who are part of the professional environment that provide support for both faculty and their fellow preservice teachers. Stephanie was an STA and found the program useful and she learned a lot throughout the year. She regretted not receiving any training in the use of the computer before the year started.

> It's unfortunate we had no training before the year started. It was basically if you thought you had a basic knowledge of computers you could apply, and if you applied you get the job. I just felt like I could have had a day with the laptop and someone telling me some of the troubleshooting because I had no idea how to fix a lot of things the first few weeks, especially professors who required a lot of assistance with things like projectors and other things in the classroom that I had never used before. (Stephanie, 2007, interview)

There was a lot of demand on the STAs that they often would get frustrated because many classmates were always asking them a question. The preservice teachers would often go down the hall to the resource centre where Josephine worked. The resource centre had hours set up from 7:30 to 8:30 AM, lunch and 3:30 to 5:30 PM where there were always three STAs working to troubleshoot, solve problems, add software, and help with any problems. The help program was not well known or promoted.

The preservice teachers learned from the faculty, Josephine, the STAs and from their colleagues. Rhonda stated that 40-50 % of what she learned in the year was from her peers.

> When we've all got the same model, it's no big deal to pick up on something somebody else learned. At the beginning of the year I didn't even know about USB's so I tried to take my laptop up to the front of the classroom to do a presentation and my classmates were like "No, no, just put it on the stick and go on the professor's laptop to do that. So little things like that, or just using MSN and getting a handout from a buddy who's online at the same time. Or just cut and paste drag, just ship it across to somebody on MSN. Little things like that help you study and get through." (Rhonda, 2007, interview)

In discussions about the STAs, recent graduate Rhonda thought their STA was great and very helpful. Kathy thought her STA was not that knowledgeable about the computer. There was someone in their class who was more knowledgeable about computers and the STA was getting paid and this person was not. This caused some resentment in the class. Andrew stated that their section had two STAs, one very experienced with computers but lazy, and one that was shy and had less experience. Kathy stated that they had a preservice teacher in the class who was more knowledgeable than the STA and often helped the computer professor but he was not getting paid for it, so he always wasn't that pleasant about being helpful.

Patty would occasionally ask her colleagues for assistance in class and would frequently ask her STA. Patty also often visited the room where Josephine was for

technical assistance and found them quite polite and helpful. She only went down to University Technology Services (UTS) once about a broken part of a computer and she did find them helpful. She never asked faculty for help including her computer professor. She thought he was a busy guy. Patty often asked her family for assistance in using ICT. She has a son and a daughter and both were helpful.

### 4.5.2 ISTE standards as guidelines

An innovation can be considered an idea or practice (Rogers, 2003). The ISTE National Education Teacher Standards could be considered an innovation that has been adopted by NCATE, most schools in the United States, UNESCO and many other countries (UNESCO 2002; ISTE NETS 2004). This innovation sets minimum standards of proficiency for students, teachers, teacher educators and administration. Countries that have adopted the ISTE NETS as legislation or formal standard, have created an incentive for teachers and teacher educators to learn and meet the standards in the integration of ICT into their teaching and learning.

These rules have been collectively adopted by organizations within other countries however, they have not been adopted by any educational organizations within Ontario. Educators in Ontario are encouraged but not required to adopt ICT within their teaching of curriculum by the Ontario Ministry of Education and through their professional body, the Ontario College of Teachers. The diffusion of the knowledge of the ISTE NETS occurs through teaching the preservice teachers in their computer course however not all faculty members were aware of those standards.

The preservice teachers learned about these implicit rules, ISTE NETS (2004) in their 12 hour computer course and completed an assignment (Appendix M: Preservice Teacher Sample Work ISTE Standards) where they evaluated their practice teaching placement on the amount of ICT integration. Since preservice teachers are required to become familiar with these ICT standards, it would be assumed that faculty would be familiar with the ISTE NETS (2004). However, the online survey indicated 71% of faculty members were not familiar with the ISTE NETS (2004).

Of the seven faculty interviewed, Karon, Donny and Aimee were not familiar with the ISTE NETS (2004) while Irene was familiar with the standards. Brenda had worked with the ISTE standards and did some research a few years ago by surveying the

preservice teachers who graduated to test their confidence levels in terms of the ISTE standards. Joan stated that she tried hard to meet the ISTE standards in her teaching with the preservice teachers but found that some of them were on quite a high learning curve. She found that some of the preservice teachers coming in to the program knew next to nothing at the beginning of the program yet most will know more that the average experienced teacher in the field after they graduated. Kevin teaches about ISTE standards in his Computer course and had the preservice teachers complete an assignment where they reported if the ISTE standards were used within their practice teaching placement.

George, a B.Ed. graduate, felt that there were a lot of preservice teachers who were not paying attention to learning ICT as there was a lack of formal evaluation in ICT, such as meeting standards or passing an exam. Other than the computer assignment where the preservice teachers evaluated their placement on the implementation of the ISTE NETS (2004), there was no formal test to determine if preservice teachers met the first standard, “demonstrate introductory knowledge, skills, and understanding of concepts related to technology” (ISTE NETS, 2004). Additional ICT workshops were provided as an opportunity for preservice teachers and were well attended but were neither mandatory nor taught by faculty.

Although the ISTE NETS (2004) are not formally recognized, perhaps these rules are being followed implicitly. The interviewed participants were asked if they felt the Faculty of Education was meeting the ISTE NETS (2004) within the laptop program. The faculty interviewed indicated if they were addressing the standard within their teaching, but often assumed that the standard addressed was being met elsewhere in the program.

Aimee, a recently hired faculty member was not familiar with the standards and was unsure of a where the standards would be taught, expecting that they would receive teaching of Standard I Technology Operations and Concepts in the 12 hour computer course. In Standard IV Assessment and Evaluation she was aware of the kinds of assessment that used technology but did not use them herself. “I don’t use any of them because, again, I would have to take a course or get someone to show me.” (Allison, 2007, interview).

Brenda, a senior faculty member, was confident that the preservice teachers could absolutely demonstrate Standard I, with a sound understanding of Technology Operations

and Concepts. She has witnessed the improved ICT skills of preservice teacher during the past years while they have attended the university. She believed that the faculty may not have applied "current research on teaching and learning with technology" part of Standard II: Planning and Designing Learning Environments and Experiences. She sensed that Standard III: Teaching, Learning and the Curriculum was well covered in the courses offered within the B.Ed. program. In terms of Standard IV: Assessment and Evaluation, Brenda believed more strategies should be taught. She considered that the faculty could improve in teaching Standard VI: Social, Ethical, Legal and Human Issues to promote the safe and healthy use of technology.

Karon, a professor who had two years experience, was not familiar with the ISTE NETS (2004), but when asked how the laptop program was meeting the standards, stated that in regards to Standard I: Technology Operations and Concepts, the program did not "demonstrate continual growth in technology knowledge and skills to stay abreast of current and emerging technologies." (ISTE NETS, 2004). She did expect that Standard II: Planning and Designing Learning Environments and Experiences was taught in the computer course but was unsure of the statement "apply current research on teaching and learning with technology when planning learning environments and experiences" as she states, "I don't really know if that is being done, and I'm certainly not doing it in my courses." (Karon, 2007, interview).

On Standard III: Teaching, Learning and the Curriculum, Karon admitted she had not addressed this effectively within her classes but planned to in the future. She expected that the Management course may have addressed "manage student learning activities in a technology – enhanced environment" but was not sure. She admitted she did try through teaching the curriculum to address the statements; "facilitate technology enhanced experiences that address content standards, use technology to support learner-centered strategies that address the diverse needs of students and apply technology to develop students' higher order skills and creativity."

When Karon examined Standard IV: Assessment and Evaluation, she stated that within her class, she discussed her personal use of the assessment software package called MarkBook, but did nothing else. In reflecting on Standard V: Productivity and Professional Practice, she did use technology out of her own interest. She considered

technology a “double edge sword” where although technology can increase productivity, but since it had not been working well at the university, it did not increase productivity. In regarding Standard VI: Social Ethical Legal and Human Issues, she sensed her assignment of having the preservice teacher create a webpage placed emphasis on ‘tastefulness’ and ‘appropriateness’ for communication with students and parents. She reasoned that since all preservice teachers were required to purchase a laptop, that this “facilitated equitable access to technology resources for all students”.

Joan also had concerns on Standard VI: Social, Ethical, Legal and Human Issues because there was different interpretations of policies from the Ontario Ministry of Education in varying degrees among school boards. She sensed that preservice teachers were aware of the issues in using ICT, although she felt school boards did not appear to have consistent policies regarding ICT.

Irene, who had taught for five years at the university, considered herself experienced in the use of ICT, was familiar with the standards and sensed that some were met in the program. Irene commented on the differences she had noticed among faculty with regard to standards, “You’ve got some faculty who would meet these standards, and you have others who would kind of sit the fence, and then you’ve got others who wouldn’t meet the standards at all. You are going to have faculty who still feel that the computer is unnecessary in the classroom. Balance… if we look at balance across the Faculty of Education, we are probably not doing too bad of a job.” (Irene, 2007, interview).

Kevin, the laptop coordinator, believed there was merit in the spirit of the standards and was aware of the updating of the ISTE NETS (2004) that was occurring. He believed that there had to be some kind of motivating mechanism in place for the faculty to learn and integrate the technology otherwise they may hide behind the cloak of academic freedom, saying technology did not apply in regards to a particular teaching area.

Jim, who is the Director of Instructional Technology who works with faculty in teaching and ICT integration, admitted he was not familiar with the ISTE NETS (2004). From a historical point of view, when he taught in the Faculty of Education since 1984 noted that in 1996, 1997 and 1998 there was only one faculty member who used a data

projector and he did not have a laptop. He had the data projector hooked up to a desktop computer on a cart and rolled it in. He tried to encourage others to use ICT through modeling but it did not catch on.

The Dean commented on how the ISTE NETS (2004) were being met by the Faculty of Education. He was confident that Standards I: Technology, Operations and Concepts; II Planning and Designing Learning Environments and Experiences; III, Teaching, Learning and the Curriculum; and V, Productivity and Professional Practice, were taught well. He stated that more improvement was needed in Standard IV: Assessment and Evaluation and Standard VI: Social, Ethical, Legal and Human Issues. He had concerns that Standard VI was becoming more of a concern for teachers with an increase of cyber bullying in the schools. He had a concern that there was an increase in plagiarism among preservice teachers who were using the Internet.

The Dean presumed that Standard I was well taught, however, there was only 12 hours of actual academic class time spent teaching Computers. This was supplemented by an initial 12 hour computer training period prior to classes starting in September and optional workshops throughout the year. To acquire proficient ICT competency skills requires a certain amount of both instructional and practice time. Recognizing that there was a wide variation in computer proficiency among both faculty and preservice teachers, there were some people who would be quite proficient and others who were not. There was not a specific assessment to determine if any of the ISTE NETS (2004) were directly met at any particular level nor was it ever expected.

### 4.6 Consequences of the innovation

In adopting or not adopting an innovation there are expected and unexpected consequences that will affect the individual and the social system (Rogers, 2003). The main issues identified by the adoption of the laptop in the study include: off-task behavior, wide range of ICT skills, technical difficulties, technical support, time constraints, ICT integration into teaching, and philosophical support and attitude towards ICT integration.

The change from a non-laptop program to the adoption of ubiquitous laptop by the Faculty of Education occurred in 2002. Although the data for this study were collected in 2007, the complete process of adoption of the laptop and ICT integration by

faculty is an ongoing process of internalization. Because the laptop is a bundle of innovations, the adoption or rejection of each individual innovation has consequences (Rogers, 2003). The introduction of a new innovation to people lacking the computer proficiency to effectively use the laptop will have negative effects. Additionally, the laptop is an innovation that requires a supportive technical infrastructure, an expected consequence of adopting the laptop. Some of the consequences results in a change of behavior of faculty and preservice teachers that in turn affect the larger social system of the institution.

### 4.6.1 Off-task behavior

The off-task behavior of some of the preservice teachers as a result of the adoption of the laptop was an unexpected consequence. This was mentioned in the survey and throughout most of the interviews by faculty and preservice teachers. The professor has a desire to teach the preservice teacher educational tools within the academic classroom, while some preservice teachers want to do other things with the computer. The professor sees value in teaching the preservice teacher these teaching tools while some preservice teachers see value in spending time on the computer doing alternative activity.

"A tool always implies more possible uses than the original operations that have given birth to it" (Leontyev 1981, p. 215; as cited in Engestrom, 1987). The off task behaviour of preservice teachers using computers in the university classroom came up as one of the main challenges of the faculty and is mentioned in the literature (Scott, 2005; Bin-Taleb, 2005: and McKimmy & Leong, 2006). This concern was described and mentioned often in the online faculty survey, the faculty interviews and the interviews of the preservice teachers. The list of off task behaviours mentioned in the faculty survey include the use of MSN, email, Facebook, YouTube, games, working on other assignments, and surfing the web. Kay (2004) recognizes the problem in suggesting that the preservice teachers close the laptops when not in use. There were a few suggestions on how to deal with this issue and they will be listed in the possible solutions. Since this was a common concern in the teaching of preservice teachers in the class, it will likely be a concern of future teachers teaching in a laptop school.

Donny had some difficulties in the past with his preservice teachers using ICQ and MSN in class. However, this year he has been managing this as a behavior problem. He has been consistent about courtesy in dealing with preservice teachers, "I listen when you speak and you listen when I speak." This modeling of classroom management has worked and he now finds the vast majority of his students have been compliant in regards to not using MSN in class. Treating off-task behavior as a classroom management issue was an effective solution to Donny's problem. Modeling effective classroom management worked for Donny.

On the concern of preservice teachers off task in class with MSN, another faculty member, Kevin, stated that many of the preservice teachers believed that they can multitask.

> I'll walk down the hall and look in at a professor teaching and look at the screens and see Facebook or Youtube. I'll actually walk into the class and ask the person 'How are things going today?' and they'll be embarrassed and click out of it. The excuse I've heard about that is 'Oh I'm a parallel processor, I need to be doing more than one thing at once.' Which if you read Mark Prensky's article, his whole premise is that technology has re-wired the youth of our generation so they think differently. And I'm sure if you talk to somebody doing research and neural studies, it doesn't matter if its technology or not, people are stimulated when they are reading or talking or doing sports. If you are stimulated, the brain research has shown that the neural pathways are strengthened so the thinking processing going on in the brain is enhanced. So what Prensky is saying, is these students, who are used to video games and MSN, they're actually stimulated by that so if you want them to just sit and listen to you in lecture they are going to be off-task and daydreaming and things of that nature but I don't know if I'm sold on that. (Kevin, 2007, interview)

Kevin described a possible software tool to block out websites that he does not want the students on. He could block out MSN, Facebook, and Youtube. This could be used as a pedagogical tool in a school. He feels that it not really "Big brother" but he feels it is worthwhile to remove the temptation of the students using these social networking systems. He also feels that he could try an experiment where half the class was blocked out and half the class was not. It would be interesting for the students to find out how productive they were with or without the social networking software blocked.

#### 4.6.1.1 B.Ed. graduates concerns about off task behaviour

The B.Ed. graduates found advantages and disadvantages to using instant messaging in class. Some appreciated the ability to communicate and pass assignments

around in class without disturbing the class while others felt it was distracting. Rhonda stated the advantages of MSN include the ability to quietly talk to the STA in the class as not to disturb anyone while the professor is lecturing. Rhonda says it had become a huge part of their lives. The whole section (40 preservice teachers) was on MSN and they could go on at anytime to find someone to answer a question if needed. The STA would always be online and he could get back to the preservice teacher instantly since the STA was always online.

Some preservice teachers found others using MSN distracting in class. The people they were sitting beside were no longer engaged in the lesson. The preservice teachers often thought that the professors were insulted by someone using MSN in class. Rhonda stated that she kept in touch with family through MSN and that was more important than a lecture. She had a brother in the armed forces serving in Afghanistan and he would not come on that often but she wanted to talk to him even for a few minutes as she did not know when she would see him again. Stephanie feels that, since everyone in the program was an adult and has paid to come into the program, if they wanted to waste their time in class chatting with someone across the room, then that was their choice. Paul found it helpful to talk to people about assignments.

Rhonda found it difficult if she was doing a presentation in class and people were on MSN. She felt her presentation must not be that interesting. If she cannot keep a class of her peers interested in the presentation, how will she keep a group of students interested? This motivated her to try to prepare more engaging lessons.

Andrew stated that many of his professors had a problem with preservice teachers using MSN in their class while they were teaching but these professors would just go up to the front of the class and read from their PowerPoint presentation. He stated, “Why on Earth would I look at the board if you’re just going to read it to me anyway? Would the professors prefer someone typing or chatting in class? Typing is a lot more polite that having little side conversations while the professor is teaching.”(Andrew, 2007, interview)

Rhonda states that she had a range of engaging teaching with professors and this determined if she would use MSN in class:

> I had classes that would be thought provoking and push me to engage in conversation and give my opinion and really engaging classes, versus me sitting there for 2 hours straight watching a slide clip from one to the next. It was that (MSN) or I slept for some of those professors because they had no interest in teaching except for telling me what they knew. (Rhonda, 2007, interview)

Rick found MSNing and off-task behavior in class distracting to him as student and found it unprofessional. He stated, "People who play solitaire during a lecture, that's not cool. If you are here for a lecture, be there and get what you can from it."(Rick, 2007, interview).

Stephanie found that some of the professors were adamant about using MSN in class and took class time talking to the students about paying attention in class.

> Professors that would be completely against it [having laptops open in class] that they would take 10 minutes or 20 minutes out of the hour and just berate the whole class for having the laptops open. We could have 10 assignments due in the same week and there's not enough hours to do them, so you know what? We're not engaged, we're going to use the time to do something else. They would just yell on us for 20 minutes out of the class and then everybody in the class would get on the defensive because not only are we adults, but we've paid for the class and were being told that we have choices. We can come or not come and just everybody went on the defensive. (Stephanie, 2007, interview)

George thought that one of the advantages of the laptop program was that when he wanted, he could tune out and see the latest sports update on ESPN and then tune back in. He did not have to pay attention for the whole eight hour day. He feels that there should be more communication between the professors to make it more meaningful and more purposeful. He is on MSN all the time, he may not be talking, but he is always looking at someone's name anything to pass the time till lunch or the end of the day.

Patty felt that most of the faculty members were proficient at integrating ICT into their teaching although some faculty had difficulty with preservice teachers on MSN. Some faculty never let the students have their laptops up. She felt it was a classroom management issue for the professors.

Cam considered MSN an effective tool used to communicate with colleagues. Cam had friends at other Faculties of Education and they found there were a lot more educational resources shared at the university he attended.

> Oh yeah, they discourage you from doing anything but I learned how to communicate with my peers really well. MSN, Facebook were mainstays of my

> day to day life. But collaborate, everybody shared all their notes, shared all their presentations so it was easier to get a hold of everything. But it discouraged me from paying attention a lot of the time so it comes with its good and bad. But I got so many more resources than I could imagine had I not had this program in place. (Cam, 2007, interview)

### 4.6.2 Wide range of ICT skills

The main prerequisite for the B.Ed. program is an undergraduate degree with no required minimum competency in computer proficiency. As well, there is no minimum level of computer proficiency in the hiring of professors. This has resulted in faculty and students with a broad range of ICT skills and this situation has particular consequences. Many preservice teachers come into the program with minimal ICT skills while others would be considered experts. This variation in entry-level ICT skills among preservice teachers leaves some overwhelmed and others bored. This was considered an internal challenge for some professors in learning how to teach a balanced lesson to the middle range of skills, yet still challenging the ICT experienced preservice teacher and not leaving behind those that required more assistance. A secondary issue existed between the professor and the preservice teacher in teaching the preservice teacher the needed ICT skills. The variation in faculty ICT skills was identified in their learning process. The different level of expertise in ICT skills between professors was another issue between professors and preservice teachers.

Irene found some of the preservice teachers came in to the program with varying levels of expertise, which makes it frustrating to teach as some are computer specialists and some are learning how to turn the computer on. A few preservice teachers told her that she was going too fast and others felt the pace of the lesson was too slow and they are not learning enough. The wide range of ICT skills was present in the faculty as well. Irene has met faculty who did not know how to cut and paste text out of an email. They printed it out and then typed it out.

A challenge that Kevin finds is the extremes in the user group from both the student and faculty perspective.

> We have some people at the university, both student and faculty, who are at what I would call the fragile end of the spectrum, and any frustrating or negative experience with technology will shut that person down almost to a standstill where it's really hard to mobilize them to engage with technology. On the other end of the spectrum, we have people who are incredibly tech-savvy, they are

> probably beyond many of the activity expectations we have built into some of our lessons and activities. That could be because of a number of reasons, maybe they are coming from a training or university background where technology was very important to them, computer science. And then there is the cluster of people in the middle who are caught between being somewhat skilled and somewhat nervous but they are making it okay. But managing that spectrum is kind of that second area of challenge that I find is consistently there. (Kevin, 2007, interview)

The dearth of ICT skills extends into the academic aspects of the program as well. Donny also finds one of the biggest challenges was getting students including preservice teachers to properly research.

> One of the biggest challenges I think is getting our students of any age, including our adult learners, to be able to do proper searches for documents and find information. When I was at U of T, (University of Toronto) I did a ten week course and it was three hours every week. It taught us how to navigate through Google and get to pro-quest dissertations online and all these things…and it had how to put in keyword searches properly. So I find now I can readily find information. Some of the students it takes them a long, long time comparatively because they aren't used to going through the different databases or even different word combinations or using synonyms. It doesn't necessarily click for them because they haven't got the experience. (Donny, 2007, interview)

The range in ICT skills exists within the faculty as well. One faculty member stated that a challenge for her, was the lack of knowledge. If the faculty were not using the ICT on a regular basis, they forgot how to use it when they needed to use it again. Below is a quote from one faculty member.

> My challenges relate to not knowing about what I need to be able to do and how to access assistance when I need it. I am trying to learn how to take care of my own website. I have had lots of opportunity to learn from FASS (Faculty Administrative Support Services), Jim and Josephine but I still need guidance over time to consolidate my knowledge. This takes time and I push it to the back burner while I do other things. When I need to work on it again, I have forgotten some of the procedures. This learning is piecemeal and unsatisfactory and at this time, I need to revise and update my website but again don't know where to start. (Faculty survey, 2007)

The range of ICT skills of preservice teachers entering the program varied from one extreme to the other. This may be due to age, or the amount of opportunities to learn ICT skills, within their lifetime. With the wide range of ICT integration found within the schools at the present time, one would expect that the graduates of the high schools and

universities will also have a wide range of ICT skills. Some of these graduates will enter B.Ed. programs and become teachers with a wide range of ICT skills.

Aimee, a faculty member, also has concerns about not knowing some of the basic skills in ICT. While she was working on a word processing program she expressed this frustration in working with ICT:

> Yesterday, I was doing a table and then maybe I pressed a button I shouldn't have but some of the lines in the table disappeared and I don't know how to put them back. I tried a number of things and I couldn't get them to come back. So I continued to work and then I'd get another idea and go back and try to fix it, but I don't know. That's the kind of frustration I am having. (Aimee, 2007, interview)

There is evidence that both faculty and preservice teachers could be more proficient in ICT skills and have indicated they would like to learn more.

#### 4.6.2.1 B.Ed. graduates comments on range of ICT skills

The preservice teachers' comments confirmed the faculty comments on the wide range of ICT skills that existed among their colleagues. Rhonda commented on the entry skills of some people.

> We had people in our section that never used a computer before they got here and they were having so many problems. They ended up all the time downstairs at the help desk, not our STA center but the help desk, UTS, because they had no idea what they were doing [UTS only addresses repairs to laptops]. (Rhonda, 2007, interview)

In commenting on the numbers, Paul stated that there was a handful out of the section of 35 preservice teachers who were really new to the computer. On the other extreme, Stephanie stated that within the group of STAs, there were 4 to 5 that had a computer programming background and were an excellent resource.

Patty is a 52 year old female Intermediate Senior graduate. Patty was an older student who wanted to be interviewed but did not want to participate in a student focus group with younger preservice teachers because of her age. Patty found, although she was exposed to a lot of the technology, she would have a hard time teaching someone else to use the technology.

> Well I understand the concepts like overall in terms of integrating technology in the classroom and the need for it and all that. In terms of having learned enough that I could teach to somebody else or explain to somebody how to do some of these procedure that we learned; I would not remember how to do a movie or

> even a website. I would probably have trouble explaining it and have to try to relearn it myself. I felt I was exposed to all these things but in terms of me knowing it now to teach it to somebody else, I don't feel comfortable with these skills because I was learning from scratch. Whereas a lot of students in my class had a lot of pre-knowledge and I had none. So my learning curve was extremely steep. (Patty, 2007, interview)

Patty felt that she should have taken a few computer courses over the years and this would have helped her in the program. She did take a computer course in her undergraduate degree back in the 1970's but that involved learning how to punch holes in a card and then load the cards into a machine. As well, Patty never took a typing course. Typing, according to her parents' views, was for those people who wanted to be secretaries. If one were going to go to university, one could get a job and hire a secretary to do all of the technical work so there was no room in the curriculum to learn how to type.

Patty had never taken a typing course and presently types with two fingers. The lack of competency in her keyboarding skills meant it took a lot longer for her to complete assignments compared to her colleagues. She felt inadequate in not being able to use the computers as well as some of her younger colleagues. She felt there should be a pre-assessment to determine the level of ICT skills prior to entering the program. She always had her hand up in the Computer course asking questions and was quite stressed about computers. Being one of the older preservice teachers in her section she was self conscious about her age.

Some of the challenges that Patty has had as a preservice teacher were the low ICT skills, including keyboarding, when she entered the program. Assignments took a lot longer to do than other people and the workload was very high. As many who enter the program she had to balance a family life with workload of the B.Ed. program. Patty felt there should be some classes offered ahead of the start of the B.Ed. program so that she could have sharpened up her computer skills well ahead of time.

> We should be aware ahead of time that a certain amount of computer knowledge is desirable. I didn't think it started from scratch at all, and I thought it would. A lot of it was assumed knowledge that I did not have and that's what I found stressful. Even just simple things like cut and paste I could do but some of the Googling, I didn't know how to Google properly. I wasted so much time trying to find the proper words to put in stuff like that. So some computer training ahead of time would be helpful. (Patty, 2007, interview)

Patty stated that she gained a lot of ICT skills throughout the year, such as using PowerPoint, creating websites, and the ability to maneuver through the Internet to search for information. The program increased her self confidence and self esteem knowing that she could now use the ICT when at times she was frustrated and thought that she would never learn these skills.

As the confidence increased in using a tool, some preservice teachers approached the inventive stage according to the ACoT scale (CEO Forum on Education and Technology, 2000) and were creative in looking for solutions for the challenges of ICT integration. George had an idea on how to integrate ICT into the B.Ed. program. He suggested that there could be short video clips of students in a classroom and then the preservice teachers could discuss that situation. He gave an example for a classroom management class to have a video of a student not being on task or talking back to a teacher in a real classroom setting. The preservice teachers could visually see what is going on and then behavior management strategies could be discussed. He suggested a similar strategy with reading. For example, there could be a video clip of a student reading a paragraph and different teaching strategies could be discussed to handle that situation. However, instead of reading case studies as they did in the Special Education example, they would show a video, thus creating a more situated and contextual example. The evolution of these strategies illustrates the process of how, once a new technology is integrated into a person's repertoire, they are better able to generate new applications using that technology. In this example, the old technology would be the reading of case studies where the description of the event is filtered through the eyes of the writer. A video or even a webcam of a case study would be more richly descriptive because it was contextualized and also holds the possibility of creating interactive elements.

### 4.6.3 Technical difficulties

The technical support required to assist the adoption of the laptop was an expected cost. A wireless environment was established in a new wing built with classrooms that had ample access to power outlets for the laptop. However, unexpected consequences included particular technical difficulties which were listed as one of the major challenges faced by faculty. This would include the Internet being down, email down for extended periods of time, wireless either down or very slow due to volume of

people on the system, or a computer would crash or freeze and the lack of electrical outlets in some classrooms. These difficulties were listed within the faculty survey, in interviews with faculty and with students. It is difficult to teach a lesson using ICT if the technical support fails. One has to have a backup lesson if the ICT fails that does not incorporate ICT. Some faculty mentioned the lack of human support when the technology fails.

The faculty who were interviewed also stated their challenges. Some of the challenges that Irene faced were the lack of reliability of technology at the university such as email going down, wireless not reliable in the classroom, different problems with the images on student computers that were identical, and printing difficulties.

Kevin stated there were many challenges that he had, in fact too many to mention but that they seem to fall into three categories. The one challenge was that the hardware and software often provide challenges as they are frequently made by humans, so they are flawed. Sometimes the technology fails and it is frustrating. To have someone try ICT and for it not to work reduces the likelihood that they would want to try it again.

> Maybe I'm using the web one day for an instructional experience or accessing a specific database online, but the Internet goes down so that particular part of the teaching experience is basically a negative one. (Kevin, 2007, interview).

The main challenge that Joan experienced was the unreliability of the wireless at the university. The technical structural support often broke down reducing the dependability of the technology.

> It's very trying and frustrating to get into your teaching and you have the technology ready. Not only is it a teaching tool but a tool the student can use in the classroom, and then you go to have them do something, and the wireless is down and you can't do anything. It's extremely frustrating. (Joan, 2007, interview)

Other challenges that Joan mentioned included, not having all of the necessary software loaded on to the image template on the preservice students' computers. In her Methods course, she taught the use of evaluation software such as E-Teacher for creating report cards. The technical support people did not have the secondary template available but they did have the elementary template. In using the Ontario Curriculum Unit Planner (OCUP), she found that some of the material for lesson planning was missing for some subject areas in the higher grades, such as civics and religious studies.

One of the biggest challenges that Donny found was a range of technical issues with different elements of the available technology. It could be a problem with a VCR, or a laptop or a software issue and these problems occurred frequently.

#### 4.6.3.1 B.Ed. graduates concerns on technical difficulties

The preservice teachers had mixed experiences in dealing with the technological support. Paul found UTS helpful when his computer crashed and he could not get his website up. Stephanie found UTS to be very unhelpful and she had many complaints from people in her section who took their laptops to UTS for different technical issues. She stated that if there were a problem, UTS would reformat the hard drive back to the original state and thus they would lose all their work. To avoid this problem they had to constantly save their work elsewhere, including personal files. Other issues came up, as the following excerpt illustrates:

> For UTS my worst experience with them was getting my new battery because it was such a hassle. Everybody got these laptops and we paid so much money for these laptops and then the batteries weren't working. We had to go get new batteries because they were apparently a fire hazard so just scheduling that to go get a new battery. (Kathy, 2007, interview)

The students, dependent on using technology to communicate with professors, expressed their frustration with the lack of communication caused from the email outage and inability to contact professors. The Webadvisor (Scheduling software) was down often as well. They expressed indignation over these problems as they had expectations that a technology integrated program should have better technical support and functions. Initially, there was a program expectation that the preservice teachers would use their university email accounts but because they were so frequently not working, many of the preservice teachers stopped checking those accounts on a regular basis.

### 4.6.4 Technical support

Although the university realized the need for technical support and hired technical assistants, an unexpected problem included the amount of time required by preservice teachers and faculty for assistance. Support can be viewed either as resources allocated towards hiring of technical assistants or supportive infrastructure. The faculty members were asked how well they felt the administration of the university supported the integration of ICT into teaching. Of the 36 faculty who answered the survey, their

responses were: very supportive 31%, adequate support 44%, some support 19%, minimal support 6% and no support 0%. The Director of Instruction, Jim, and technical assistant Joanne, both stated that they need additional help in providing assistance to preservice teachers and faculty. Jim described the qualities that he would like an additional technical assistant to possess.

> We need people who have expertise in teaching, who have expertise in instructional design, who have expertise in technology and a variety of application programs, and we need people who have excellent communication skills. You can probably find people who have one two or three of those skills but don't have all four of them. And the communication skills are very important because if you don't have those, if you don't have the ability to develop trust with your profs or small groups, it's just not going to run. So that's a large barrier. (Jim, 2007, interview)

Stephanie found her work as an STA the busiest when all her assignments were due. She had to help them with little things that they learned in class like how to save, how to print off documents, where things were on people's websites. She thinks that it would be helpful to compile all the trouble shooting skills into a series of support documents and let people know where to find them.

Sabrina was an STA and thought it was important to have more training for STAs prior to the orientation. She suggested that a search engine window would be useful on the university portal web page.

### 4.6.5 Time constraints

An unexpected constraint was the extra time required to learn and using the technology. Time was frequently mentioned as a concern, because without sufficient time to become familiar with technology, faculty would fail to become proficient users. This finding has emerged from many previous studies of ubiquitous laptop teacher education programs (Lim, 1999; Stewart, 2002; Brown & Pettito, 2003; Thompson, Schmidt & Davis, 2003; Wicker & Boyd, 2003; Scott, 2005; Resta, 2008). This issue about time could have multiple and divergent consequences. On the one hand, how one spends one's time can often be a personal choice which may make the time a factor. Responses from the faculty survey also mentioned the issue of lack of time, including related concerns in that because of the lack of time spent learning ICT knowledge and skills, there was a subsequent lack of ability to solve problems when they arose, or how to effectively

troubleshoot. The result of this situation was to use up even more time. When applications were used infrequently, faculty forgot the details of their use and again this required time to relearn what was forgotten. It took time to become familiar with the software again if it was not used all the time. The lack of time came up frequently including the lack of time to experiment and create new ICT applications or time to put lessons on the computer in a meaningful and engaging manner.

Some of the challenges that Karon expressed regarding factors that hinder ICT integration included not having enough time to learn how to integrate, not having enough resources and the technology was not working. Sometimes the technology that has been ordered had not arrived and often the Internet was down. There is a lot of time wasted waiting if the technology was not working. She finds it took a lot of time to prepare to teach using ICT as well as putting instruments away.

Joan lamented about her lack of time on learning how to use the Smartboard. She said, “I teach in (a certain room) and had the Smartboard there all year and never had three seconds to look at it and I hated that.”(Joan, 2007, interview).

One of the challenges that Brenda found was determining how much teaching should be delivered using ICT. She found it quite time consuming to learn different kinds of software and set up some of the ICT within a class. She gave an example of the time it takes to learn how to use Read and Write version 6 (software), where anything that is capitalized is read out in individual letters. Time management was a concern with faculty and as well with preservice teachers.

#### 4.6.5.1 B.Ed. graduates concerns on lack of time

A specific example of the lack of time was mentioned by the preservice teachers. In using ICT for assessment, Markbook was one of the software programs loaded on the laptop. Cam was given about one hour of instruction on the software which he felt was not enough time to learn how to use the program. He also did not have the opportunity to see how Markbook works in a practicum situation. Cam’s associate teacher used paper for recording marks and then calculated it once report cards were due. Mary mentioned the importance of actually using a program in a practical situation to fully understand it, rather than being shown how it works.

> I think I had maybe an hour of in-class instruction on Markbook, and then I went to an actual Markbook workshop. I'm pretty good at computers. I'm good with them and then I realized that I didn't really know how to use it even though I had been taught and I went to an extra workshop. I couldn't use it until I actually used in on my placement and became familiar with it. I think we were kind of glazing over it and saying 'Yep, we taught you Markbook.', but you just really have no idea how to use it until you have to. (Mary, 2007, interview)

Cam agreed with Mary's comments on this teaching. There did not seem to be enough time within the computer course to fully teach a computer program such as Markbook. The difficulty was in their haste to expose a lot of software programs to the students; some faculty members were not modeling effective teaching strategies for the proper integration of ICT.

> The weird thing is we were told (from faculty) all year, 'Don't just show people how to do things, you have to walk them through it. You got to show them, you got to do it different ways.' And then in our class we were just quickly told, 'This is what you do, this is what you do, this is what you do, this is what you do.' And then we never really got a chance to do it. I'm sure that's a time constraint thing. I mean, we've got to learn content as well as how to apply the content and then assess it, so it's a time thing. (Cam, 2007, interview)

The time allotted for ICT in the B.Ed. program included 12 instructional hours in a Computer course. This was supplemented with two days (12h) of orientation workshops prior to starting classes. There were additional optional workshops provided by Josephine throughout the year and a two day technology conference with workshops in January, 2007.

George appreciated that the laptop was full of software programs but he felt he was not exposed enough to the programs. For example, they used Smartboard in class for two hours but they feel they still do not know Smartboard. There was exposure to some of the programs but the preservice teachers do not know how to use them. He felt more time was needed to get to know how to use more of the software on the laptop.

The preservice teachers in an interview discussed the point that there was so much to learn in regards to ICT that the program could be lengthened. There had been suggestions for many years at the Ontario Ministry of Education and Ontario College of Teachers level of extending the B.Ed. program. As of now Ontario is the only province in Canada that has a 1 year consecutive B.Ed. In the focus group interviews, the preservice

teachers found it to be a ‘whirlwind’ one year. If they had the chance, they would have taken time to get to know all of the computer programs.

Inequity of ICT teaching existed in the B.Ed. program because of the additional optional workshops. There were a number of additional voluntary workshops throughout the year which were beneficial to the preservice teachers. If the content and skills taught in the workshops are valuable and important then it might be considered being placed in a course where it can be taught and evaluated so that all preservice teachers leaving the program have the same set of skills.

### 4.6.6 Integration of ICT into teaching skills

A key factor in the implementation of the laptop program was the need for effective strategies in educating faculty how to integrate ICT into their teaching. One faculty member from the survey indicated that they would like to utilize ICT beyond its use from replacing a chalkboard and an overhead projector to PowerPoint and would like to learn how to be creative in integrating ICT into their own teaching. This issue could be considered key as it may be the responsibility for the faculty to learn how to integrate ICT. Some faculty members were looking for examples on how to integrate ICT into their teaching. This is a challenge for faculty as teaching with ICT was relatively new and indicates faculty development would be beneficial.

There would be an assumption that faculty teaching at a ubiquitous laptop B.Ed. program would have a command of the use of integrating ICT in the classroom. However, this quote from a faculty member indicates that they recognize their lack of knowledge and skills. Some faculty have a fear of using the technology as well as being embarrassed as they do not know as much as the students.

> The biggest challenge is overcoming my own fear of the technology. I don't feel that I have a strong enough background to comfortably integrate the technology into the classroom. This is why I use guest speakers. Getting used to it (ICT) myself as often the students know more about it than I do. I have had to learn to deal with this disparity in knowledge without being embarrassed and rely on them as experts to assist me. (Faculty survey, 2007)

#### 4.6.6.1 B.Ed. graduates comment on faculty integration of ICT

Rhonda talked about how the lessons should not always be a transmissive lesson and should be more transformative, indicating a lack of modeling. Using the laptop was not always the best lesson.

> If they are trying to teach us how to be teachers, show us how to engage our class and how to make it hands on and fun. They were more like transmissive style teaching than transformative. I found the classes I got the most out of this year were classes I didn't even have to take my laptop out. I didn't require it at all. Like if it was left in the bag, I was fully engaged. Not classes where they're like 'download these notes and follow along'. (Rhonda, 2007, interview)

Lynn comments on the perils of working in a group. Often the preservice teachers worked in groups to complete assignments. This was done for a number of reasons. One could be to show the benefits of cooperative learning. A presentation assignment would take a lot of class time if anywhere from 35-38 people in a section each completed a presentation. The other advantage was that a professor would have to mark perhaps 10 group presentations which would cut down the marking load. Working in groups presented its own difficulties in that there was not always an equitable distribution of work or learning. Lynn describes how she avoided using technology within a group situation. She used her age as an excuse to avoid learning how to work with ICT.

> I made it a point to have a younger person in each one of my groups and let that person do all the technical stuff that was necessary. My kidpix thing that I had to do for science, I have no idea how it got from my computer to that disk, and then I don't know how to get it back from my disc to my computer to run it. So I let my partner do all of that. I was that person who didn't know how to do that technical stuff. (Lynn, 2007, interview)

The preservice teachers found a wealth of information on the Internet but its use had some concerns as well as benefits. Mary found that she did not use her time wisely when surfing the net for information. Lynn stated that she found herself surfing the net and finding the same topic presented many different ways and it was difficult to choose which to use. Cam found a math site that had all of his handouts and tests prepared for the content that he was teaching. This one particular site was perfect for him and saved him a lot of time. Lynn speaks to the advantages of finding something worthwhile on the Internet. "Yeah the old saying 'Don't reinvent the wheel' kept coming up you know. I'd be trying to figure something out and then you Google it and oh, that's how you do it!" (Lynn, 2007, interview)

This does bring up another concern about creativity within the preservice teachers. If they can continually find great lessons and ideas on the Internet why would

they try anything new? Cam comments on how some people have the ability to build on someone else's ideas and to find a better way of doing something.

> Yeah, we heard that phrase a lot this year 'Don't reinvent the wheel' But it was kind of an epiphany for me one day and I turned to the person next to me and said 'What if there's a better way to do the wheel though, why wouldn't you reinvent it?' But sometimes there was a better way to do it than anything else I could find, but sometimes by looking through all the ideas, I'd get those ideas, 'Oh this isn't going to work, this isn't going to work, so this leaves this as the only other option.' But it wasn't covered by anything so it created a process of elimination for me a lot of times. I found most of the ones that worked best for me were my own ideas instead of trying to use somebody else's. Because they had an idea in their mind when they set it up but then when I was trying to read it off the Internet, the instructions just weren't there the same way they should be for me to understand it. So I'd have to come up with my own thing to understand how I was going to use it properly. (Cam, 2007, interview)

On the use of extra technology at the university, the students lamented that although they were exposed to the Smartboard, they did not have a chance to use the Smartboard as much as they would have liked. In order to learn how to use technology one has to play or try the technology but, there were very few Smartboards to use. They were impressed that it was so interactive with the students in the classroom. Lynn and Mary did not get to use one but Mary is considering buying one. They also discussed buying a data projector for themselves for use in a classroom.

> One thing I was disappointed about this year, was not getting to use the Smartboard nearly enough. It's the most incredible technology ever and we got exposure to it and I wanted to use it but it was booked out all the time for technology class. (Cam, 2007, interview)

Mary expressed the fact that a lot of faculty did not know how to use the Smartboard. She stated that, if the Smartboard was in the classroom, most faculty members just pulled the screen down in front of it. One professor taught them how it works but never used it again.

### 4.6.7 Cost of laptop

One anticipated consequence of the adoption of the laptop was the extra financial cost to the preservice teacher. However, an unexpected consequence was the reaction of some preservice teachers to the high cost and how this affected their attitude towards ICT. The preservice teachers were concerned about the high cost of the laptops and the price difference between the Faculty of Education compared to the local computer store.

The cost of laptop as a concern was previously identified by Bin-Taleb (2005) and Rader (2005). The students paid $1400 for the Toshiba A100 laptops and they could purchase the same model for about $600 at a local retailer once classes started in September. The university had some control over the final cost to preservice teachers. The total price of the laptop included technological support fees that the university imbedded into the purchase price. The extra fees covered the wages of the STAs, technical support personnel, and software licenses. The complaints of the price of the laptops, coupled with software deletion at the end of the school year created a negative attitude towards learning about ICT with some students.

Karon found that the costs of the laptop are giving the students a negative attitude towards using ICT.

> There was one preservice teacher who in protest because of the cost, halfway through the year decided never to bring her laptop to class. She wanted to prove that she could go through the rest of the year without using a laptop in class. She resented having to be forced to buy the laptop and then not using it in many classes. She completed all the work, but did it at home and she graduated. (Karon, 2007, interview)

This indicated that it was possible to graduate from the program without having a laptop. This appears to be an isolated case but does raise some concerns if others chose to follow this behavior.

#### 4.6.7.1 B.Ed. Graduates comment on laptop costs

The tensions were apparent around the issue of laptop cost. The apparent difference between a local retail price and what the university charged for the laptops created some bitterness among the preservice teachers. Stephanie describes the sentiments of some of the preservice teachers in her section.

> I thought for the most part we had a lot of assignments that could be related to technology and it really was up to me as a student to take it in that direction and push my own learning. And I found there was people in my section that complained about the computers, didn't bring them to school, hated them, didn't want anything to do with it and didn't understand why they cost so much and why we had to have them. When it was really a matter of bringing it and asking that teacher what programs can we use with this, and you know like initiating some of that for yourself and being proactive and going to the workshops and bringing back that knowledge to class again. (Stephanie, 2007, interview)

The cost of the laptops as well as the fact that the laptops would be wiped clean of licensed OSAPAC software at the end of the year was a main concern and sometimes the STAs had to answer the questions for the university. These concerns have permeated throughout the year to the point that the attitude of the preservice teachers was soured towards the use of ICT.

> I think the idea is not knowing the breakdown (of the price of the laptops and fees) and seeing those same computers offered for $600 and the idea that our computer is going to be wiped and we're not going to have any of that at the end of the year has brought a lot of hostility towards the STA's. A lot of them have become very sensitive to the subject but they'll have very mean responses where they'll almost turn around and bite your head off and you're just asking a simple question. But you realize that they've been asked that by every person in the education program all year and it's become kind of a touchy issue with the STA's. I feel bad that it has come down on their head so often that we don't understand why the computers cost so much money. (Rhonda, 2007, interview)

The challenge for the Dean was to come up with an arrangement of costs for the students that are reasonable. Several models of leasing and ownership were tried over the years each with advantages and disadvantages. The price of the laptop dropped from the time the laptops are initially purchased in April or May to the time the sales are on in computer stores in September. The Dean was aware of the preservice teachers' complaints:

> We have to buy the computers by about April or May. We know what the cost will be. But by the end of August in any given year, depending on the life cycle of that computer, the company may be coming out with a whole new model in the fall and so all of a sudden they are going to start dumping the model we bought at a sell off price. Then our students they are given this computer and are paying this amount of money, plus they are paying 400 or 500 more on top of the cost of the computer for support. We told them the computer cost this much, they are saying, 'We're paying 1,400 for this computer.' And they're seeing it for 700 in the store and they are saying 'You are ripping us off.' So we have not successfully sold that and that's a big issue because our relationship with the students is important to us and we don't want to see it as we are ripping them off. It is the one negative we can't seem to solve. (Dean, 2007, interview)

The preservice teachers applied to the B.Ed. program to become teachers and some were not aware that there was a laptop program. Fran stated when she applied for the B.Ed. program she did not know that the university had a laptop program and Sabrina states conversely that many people have applied because of the laptop program. Not all

were concerned about the cost of the laptop enough to let it ruin their learning experience. Mary states that overall, “I definitely think this was an excellent program and I’m glad, like, I’m not complaining that I had to spend the money on the laptop at all. I think it was a good investment.” (Mary, 2007, interview)

### 4.6.8 OSAPAC software

When the laptop was adopted by the university, an expected consequence was the realization with the existing regulations in software licenses that any software put on the laptop would eventually have to be removed prior to finally selling the laptop to the preservice teacher. Most educational software loaded on the laptop is licensed through Ontario Software Acquisition Program Advisory Committee (OSAPAC), under the Ontario Ministry of Education, that can be used on computers owned by educational institutions or employees in Ontario. Any laptop program school or Faculty of Education in Ontario is under the same restrictions. The software license agreements were created in a time when only schools would own the computers which were mainly desktops but now the trend is growing for laptops. Both schools and Faculties of Education exist where people own their own laptop and are not eligible to download OSAPAC software onto a personal machine. The ‘bending’ of the rules occurs at the university where the laptops are ‘leased’ to the preservice teachers at the beginning of the year and they can ‘purchase’ them at the end of the year when the software is removed. While the removal of software was an expected consequence, the negative reaction of the preservice teachers was of considerable concern, yet provincial regulations left no options in this regard.

At the provincial level, the Dean describes some of the difficulties he has had with the Ontario Ministry of Education and the licensing of software. This software issue has created many difficulties for the preservice teachers, faculty and administration.

> I have a lot of difficulty at the provincial level, as you know we have real problems with all this educational software that the Ministry of Education is coming out with and licensing. They just won’t let us get access to a lot of it. They want the schools to have access to it but they won’t let us get access and that’s very frustrating. You would think if anybody, you would want all the Faculties of Education to have access to all the Ministry publications for all the future students but they seem to think that our students are going to go all over the world. They’re not necessarily going to teach in Ontario. They just don’t consider us enough. There are a lot of obstacles to get access to Ministry approved software because we are not in the public school system. Which explains why it’s

> created, it's forced us actually, to create almost a façade of protocol, but we are following it. That is, the university might be site-licensed for some things but we then have to remove it off the student's computers as we pass over ownership to the students. Then they go out and they will re-install it when they get to the school system and it seems to me that that shouldn't be necessary but we can't get around that. (Dean, 2007, interview)

Stephanie, a preservice teacher, comments on the amount of unused software that was on the image:

> There was a lot of software on the computer that has never been opened and it is unfortunate because it cost a lot of money, it increased the price of the program and we never got a chance to open it and then we lose it. We used like less than 10% of the software. (Stephanie, 2007, interview)

Cam, an Intermediate Senior recent B.Ed. graduate, lamented the fact that the image of the computer as in most of the software on the laptop was for the Primary Junior level and very little for the Intermediate Senior. He did not feel that the grade one students who were using the computer just to learn how to count needed it as much as the Intermediate Senior students who really should be using it more to enhance their educational experience.

### 4.6.9 Philosophical support and attitude towards ICT integration

A consequence not really taken into account in the implementation process was the variation in philosophy and attitude toward ICT integration held by faculty. The following comments from the survey were from faculty members who indicated an overall lack of laptop use within their teaching, but who still utilized ICT within a single assignment.

> Usually, I do not want my students using their laptops in class! I design my lessons to encourage them to talk to one another in groups, and interact on a more personal level than through ICT. When presenting the ICT assignment, however, I walk them through the process of accessing the web-based database, and offer them time to work on their PowerPoint assignments (in pairs). (Faculty survey, 2007)

At the other end of the spectrum another faculty member had the preservice teachers use the laptop all the time in class, illustrating the range of experiences preservice teacher may encounter within the program. "The preservice teachers use laptops all of the time in class. They are used to record notes, access the Internet for information and to create assignments." (Faculty survey, 2007).

The attitudes of all of the people at the institution do not always change at the same rate. Some people adopt innovations earlier than others for their own reasons (Rogers, 1962). One faculty member on the survey stated a more philosophical point of view which went back to the basic premise on why ICT was being used.

> Increased consideration and discussion of why we are using a particular ICT delivery form or software. I don't believe because ICT exists that is necessarily the most effective way to teach students to teach. Often that requires thought, conceptualization, justification and practical experiences. If ICT can be shown to support this then they can be used, if they are just a fancier way of doing the hard work of learning how to teach then I'm not so sure it is worth the time and effort and money to use. It's an ongoing consideration that we all have to engage in. (Faculty survey, 2007)

This statement is important as it recognizes the views of some faculty and their reluctance to change. Cuban (2001) has previously described many of the concerns listed here. The comments about strategies and costs have to be considered and also one has to weigh in the cost of not using technology.

When asked about the challenges that Jim has in his position as Director of Instruction, he referred to the varying attitudes of faculty in regards to technology. This response would include both the Faculty of Education and the Faculty of Arts and Science. Jim indirectly referred to Roger's (1962) diffusion of innovations in regards to professors accepting technology. Their focus was on research and less emphasis on teaching.

> I would say 10% of our faculty are go-getters and when it comes to technology they are off and running on their own. We have 10% I refer to as laggards, they are behind and don't want to touch technology. That leaves 80% and I would say of that, half of them, 40% you've got to sell them. And you've got 40% who are negative, really hesitant. So I've got about 10% on their own, 40% I've got to sell them, but I can sell them, so that's 50%. But I've got another 50% that have other priorities other than technology. They haven't been convinced, or they've had negative experiences, and they use it as an excuse. I'll go to them and say 'There's a workshop coming up' and they'll say 'I can't.' This has been validated a number of times. They'll say 'I can't get into the new technology, research is a higher priority for me' and I'll say 'Why is that?' and they'll say 'Research is where the rewards are.' Assistant profs say, 'If I'm going to stay here and get tenure it's not going to be because of the teaching, it is going to be because of the research.' So we need to change the reward structure around here so teaching is valued at the same level as the research. (Jim, 2007, interview)

#### 4.6.9.1 B.Ed. graduates state additional concerns including faculty attitude

Stephanie commented on professors that taught a subject, and did not talk about integrating ICT in the class. The only time ICT was used was for a short time on where to find resources. There was a lack of integration of ICT within teaching.

> If I look at our math class, we were not allowed to have our laptops open ever. It was taboo to even discuss technology but on the other hand she did introduce us to what math programs were on the computer, how to use them, where to find resources and what grade levels were available. So she was knowledgeable about what math programs are on the computer. Yet we weren't actually allowed to try them out and use them in her class except for the one 20 minute time of Tinkerplot. (Stephanie, 2007, interview)

Mary commented on her frustration on the variation among the faculty in how they used ICT in their teaching and there was 2 to 3 faculty who chose not to use the laptop in their teaching.

> In terms of faculty, I found it really, really frustrating when some professors would really use technology and show you different ways to use that and other professors just wouldn't even let you open your laptop. Now I can completely understand their reasons for doing so but just the fact that we are forced to buy into the laptop program and the fact that professors say just don't even bother bringing the laptop because we're not going to use it at all in the classroom. It just kind of, it really frustrates me the fact that we have to spend so much money on it and then we're not even using it in all the classes that we could be and I understand their reasoning for doing that but at the same time we should at least try. (Mary, 2007, interview)

The preservice teachers were disturbed that the university endorses the laptop program but some of the faculty did not. The preservice teachers felt caught in the middle of this pro-laptop vs. anti-laptop debate as they were forced to buy the computer but they were unable to use it in some classes. They did not want to be in the middle of a conflict, but just wanted to have the best program possible.

When asked if the faculty integrated ICT into their teaching, Cam an Intermediate Senior preservice teacher states that many were great at integrating. The part time people, who taught many of the teachable subject areas lacked skills in integrating ICT.

> Some of them [the professors] were fantastic. [a professor] was brilliant. For methods she had all of her templates all up on her website. It had direct instructions and it was things we could follow along with. ... So she did a very good job and several other professors I found that, as Mary mentioned earlier, with several teachable subjects, fell well short. And that's the ones where we're

> supposed to be learning how to teach the subjects, like not the theory of teaching, it's the practice of teaching there and I was history and religion and neither of my religion teachers even knew how to turn on the computer. To tell you the truth, one of them called it a 'lametop' all of the time actually to show his attitude towards the laptops and he didn't have a website set up didn't plan on doing that. (Cam, 2007, interview)

Cam reinforces the need for modeling of integrating ICT into teaching. This modeling could be applied to both the professors and the associate teachers (Lortie, 1975; Weeks & Kariuki, 2003). "You know what, most people tend to mimic what they've learned. If my teachers aren't using technology when they are teaching me then I'm not going to learn how to use it in terms of teaching." (Cam, 2007, interview).

Cam stated that many of the faculty had different views on the laptop program and they should all have the same views to endorse the program. Mary felt frustrated that some professors would completely ignore that they had laptops. Cam summed up the differences and the need for cohesion among the faculty and the B.Ed. program in regards to ICT.

> I only have one suggestion and that's one really strong suggestion and that's the entire faculty needs to endorse the program. They should have a common ambition of how to use the program because they all seem to be going in different directions. We didn't know where everybody was going, and it just seems like we get caught in the middle of everything. Some professors will badmouth the program and others will sing its praises but they all need to kind of take the same line on things and figure out what they want to do in the program. They should decide who is doing what in the program so they don't have to overlap and all teach us PowerPoint in the 14 classes and not teach us anything else. So even if they had like one group meeting to figure out 'Okay, what are doing with this program?' (Cam, 2007, interview)

Integrating technology into teaching was not something that Patty contemplated prior to coming to the university. She was encouraged, through her Computer course, to integrate ICT within a lesson. While on her practicum, Patty considered ICT in her planning in trying to use the computer lab facilities in the high school where she was completing her practice teaching and would use PowerPoint in the implementation. Participating in a laptop program changed her view of teaching as prior to attending the university she would not have considered integrating ICT into her teaching.

George spoke to the changes in society and how the university is moving with the times. He felt that he benefited by coming to the university but wished the professors would have taught them more about the laptop.

> As society changes the university is moving with the times. It's proactive rather than retro-active. So as time goes you'll start to see more Smartboards, more projectors in the school system. So we are getting that competitive advantage from the university. So we're definitely going in the right direction. (George, 2007, interview)

For Kevin who teaches computers, the challenge was one of inner leadership. He was concerned that he may become complacent with the technology. He has mastered the PowerPoint, website and the podcast and wants to ensure that he continues to challenge himself at a self generated discomfort level so that he can expand his abilities.

### 4.7 Increasing the adoption rate of ICT integration

A summary of the suggestions from the faculty for solutions to increase the adoption rate of ICT integration within their teaching, taken from the survey and interviews, are listed in Table 13. The suggestions that require minimal resources and could be done immediately include: creating a website that has frequently asked questions, a tip of the day could circulate on email, peer helping session where faculty can brainstorm and share ideas on how to integrate ICT into their teaching, visiting laptop schools in the regular school system, have regular talks about ICT at faculty meetings, have each faculty member set their ICT goals for the year and then check for progress, and have more training for new faculty. Suggestions that would require more organization and resources include: provide more systemic in-service training for full and part-time faculty, have mandatory workshops to increase attendance, decrease teaching load to give more time to learn about ICT, have incentives for learning and integrating ICT, hire more technical assistants, and have smaller class sizes.

**Table 13:**
**Faculty Suggestions to Increase ICT Integration Into Teaching**

1. A formal mentoring program for faculty should be created where they can easily pick up the phone or email and ask a question.
2. A website could be created that would have frequently asked questions.
3. A tip of the day could circulate on email.
4. More in-service training is required. Provide inservicing for part-time professors.
5. More workshops should be offered.
6. Mandatory workshops, rather than optional workshops should be given.
7. Peer helping sessions should be given where faculty brainstorm on how to integrate ICT into their teaching.
8. A decreased teaching load to give more time to learn about ICT.
9. Incentives could be given for learning and integrating ICT.
10. Observe and learn how to integrate ICT by visiting existing laptop schools in the regular school system.
11. More human support, technical assistants are needed.
12. More time should be given to learn how to use new technology.
13. Tutorials should be given on different topics.
14. Professional development should be given on a systematic basis.
15. Faculty should be given the opportunity to share with colleagues how they are integrating ICT into their courses.
16. Better communication with preservice teachers and associate teachers in the field regarding ICT.
17. Talk about ICT at faculty meetings and keep it regular. Make us aware of new programs
18. Ask faculty to set their ICT goals for the year and then check to see if they did progress.
19. New faculty orientation needs improvement.
20. Rethink the classroom organization, 40 people in a room with 40 laptops with 40 extension cords running every which way is not safe. (Faculty survey, 2007)

### 4.7.1 Successes of ICT integration

Other than courses that have assignments with ICT expectations, there is no direct evaluation of the level of ICT skills of the preservice teachers prior to graduation and no evaluation to determine if they have the ability to integrate ICT into their teaching. Generally from student focus interviews, there is anecdotal evidence that learning has occurred in the use of the computer by some preservice teachers but it is not known at what level of proficiency nor are there existing ICT standards used to determine a level of competency in ICT.

The preservice teachers in the interviews stated that some of the advantages of the laptop program are: they had a resource at their fingertips all the time, information was easily accessed via the Internet, OSAPAC software was on the laptop including the

curriculum expectations. The word processing functions made it possible to organize notes, and presentation software facilitated teaching. There was an opportunity to have everyone's notes, resources, and activities in the sharing of compilation CD's at the end of the year.

The faculty interviews revealed that, for Irene, the biggest success is looking at what the preservice teachers have accomplished at the end of the year when they handed in their professional looking lit-folios which incorporate Microsoft Word, Publisher, PowerPoint, and photos. She was pleased to see the preservice teachers moving comfortably in and out of WebCT, using templates and using technology as a tool.

> I think probably when I look back at what I've done over the course of the year, and I look at what I've been able to teach them in terms of technology, I will often look to their lit-folios, recognizing that some of them are black and white people and some of them are colourful and some of them are fancy borders…but that's something to celebrate because they've each been given the opportunity to find themselves in technology and to use technology as a tool to represent who they are as literacy teachers. (Irene, 2007, interview)

In relating successes that Karon has had in her teaching she speaks to some of the advantages and disadvantages in teaching and learning with ICT.

> I think what I like to see is whenever students realize how to go about doing something using technology that's going to make their life easier, and see how it can be done faster. However using technology is a double edged sword because with the courses I teach in math and science, yes, technology can be a great assistance to both the preservice teacher and student in school because you can use a calculator to do just about anything. You just have to plug in the right numbers but that doesn't mean they understand the underlying concepts. (Karon, 2007, interview)

One of Kevin's successes was the purchase of three Smartboards for the Faculty of Education in 2005. He provided the rationale, which included data on how many Smartboards were being used in Ontario schools and then presented this proposal to the Dean and they were purchased and installed.

Kevin's successes come from the feedback he received from the preservice teachers out on practicum. He often hears that students have had a wonderful lesson using PowerPoint that really engaged the students. He also liked to hear how they problem solved when the technology does not work. He suggested to the students that often the technology will fail so it is always good to have a plan B and a plan C.

Kevin was pleased to hear that there were faculty members who used the Smartboards in their teaching. One faculty member taught a lesson on the smart board where the students cannot speak verbally. Everything in the class has to be digitally recorded and put on a CD or DVD and run through the Smartboard. He was pleased when he saw people who recognized the opportunities to think creatively and share this with other faculty.

Another success that he enjoyed was the change in attitude of preservice teachers. Often they come in to the course with a negative attitude towards ICT and then, by the time they have graduated, they would have let Kevin know that they have used technology in their teaching. He received emails from these students stating, “Hey, I am using the Smartboard in my classroom and I just wanted to let you know.” And, “Hey, I am teaching in England now and I guess I will take your advice and start using the technology. Can you help me out?” He may dialogue through 5 or 6 emails while the graduated teacher makes some progress.

Joan has had success in her slideshow PowerPoint presentations and her website. She finds that the preservice teachers download a lesson from the website and then add their own notes to the PowerPoint presentation. The students on her evaluations have praised her website.

Brenda felt that she has had success with the preservice teachers using her website. She has taught them also about some assistive technology for special needs students. Aimee observed a student that had integrated technology within his lesson when she was supervising an international placement in England. She was uncertain on how the preservice teachers are doing in the school system in Canada. Jim stated that he had about 50% of the professors use ICT in their teaching. This included faculty using websites and PowerPoint effectively.

### 4.7.2 Preservice teacher use of ICT in the classroom

Kay’s results (2007) suggest that the significant learning can occur with preservice teachers in a laptop program when the experiences are authentic. This represents an extension of the diffusion of innovation cycle in that the eventual classroom adoption of an ICT tool taught by faculty, indicates the successful adoption of the innovation by the preservice teacher. The preservice teachers were asked if they

integrated ICT within their practicum. The answers overall were mixed depending upon the preservice teacher and the teaching environment. Some had an associate teacher who actively integrated ICT and the accompanying classroom technical support during their practicum. There were other schools that had the classroom support but the teachers lacked the technical expertise to implement ICT. Then there were schools that had neither the technical support nor the teachers with the ICT integration skills.

The preservice teachers spent 13 weeks in practicum and may or may not have an opportunity to integrate ICT into the practicum, depending on the school board, school and associate teacher. Kevin has had an opportunity to work closely with three school boards in Ontario as a faculty advisor. He commented on the preservice teacher having an opportunity to integrate ICT into their practice teaching. Kevin found that there was no consistent model dictating how ICT is going to be integrated into the classroom. He has seen many different attempts, where people throw finances at technology, putting technology in the schools but not supporting technology development. He has seen school administrators pro-technology but the staff is not. On providing in-service professional development for teachers in the classroom, he states:

> I guess what I've noticed and maybe from my perspective is, and maybe it is a positive, there is no restrictive model out there that makes a teacher use technology or forces them to use technology in their class. Why actually that is a positive is, I really don't think a lot of the in-service population are ready. The professional development models that are out there right now are ineffective. I've gathered research right now for two years on what kind of professional development is being delivered in Ontario schools for our students on placement. And over half of them have no professional development. About another quarter of the schools have sporadic or irregular professional development and the last quarter responded with adequate. If you look at that, that's I think very dangerous from an in-service perspective. How can we expect teachers to utilize technology in the classroom if we aren't giving them professional development activities? (Kevin, 2007, interview)

The preservice teachers may be taught what types of ICT to use and how to use it but often they do not get an opportunity to use the ICT in their practicum. On the practicum, Kevin has surveyed students and 90% of them feel that the greatest learning experience was in the practicum. Most people would agree that the actual teaching of the students was a worthwhile experience. However, many schools do not support the integration of ICT. They may have no ICT, a lack of money for ICT, they may have ICT

but no training on ICT. Kevin describes an example of the use of a Smartboard in a school.

> I'm at a school in the wintertime and I ask the person, 'Where can I hang my coat?' They say, 'Hang it over there on that whiteboard.' And the whiteboard was a Smartboard, and they didn't even know that it was a Smartboard! There was graph paper on it and there was writing on it with a dry erase marker. To me it was a top example where the school throws money at the topic, equipment arrives, there is very little to any in-servicing that is effective and the equipment just lies sterile. And then these negative attitudes towards technology fester away and you get people being bitter about it because it comes off as a waste of investment. (Kevin, 2007, interview)

Kevin felt that there was a need to train teachers in teaching with ICT. One of the best methods he felt was setting up a mentorship program where every school board has a significant number of key teachers who are using ICT in a creative way and other teachers should be able to visit their classrooms and learn from a mentorship point of view.

Josephine, the B.Ed. technical assistant, when asked if she knew if the preservice teachers are integrating ICT into their practice teaching, a sign of a successful outcome, gave a mixed response stating many have integrated and many have not. She has had preservice teachers tell her about a great lesson they taught using technology with a Smartboard and the students creating a movie together as a class. In some schools the preservice teacher has been the only one in the school who knows about using a piece of technology, like a Smartboard and the preservice teacher would then give a workshop to the other teachers about the Smartboard during the practicum.

> I have students coming to me saying 'My school had a Smartboard and nobody knew how to use it and I set it up and even ran training workshops for the other teachers.' This is a student teacher walking into a new school. It is exciting for them because they're integrating and because they're integrating they're almost being seen as leaders, technology leaders, walking into school. So that in respect of dealing with the other teachers in their schools, they're definitely integrating and passing it on to the other people they work with. There were also reports from some schools that had limited technology where it was too much work to book out the data projector and they would have to compete with other teachers to use it. (Josephine, 2007, interview)

Josephine has heard from graduates of the program who have been successful in integrating ICT within their teaching. She gave one example of a B.Ed. graduate from a

previous year, who taught in a remote First Nations community, and used a music program where the students wrote their own songs. He sent her a copy of a "Rap" song created by a 16 year old and she said it was quite good. The students were quite proud of their music creation.

#### 4.7.2.1 B.Ed. graduates experience using ICT in their practicum

Rhonda had two different experiences with her associate teachers while on practicum. The first associate teacher wanted someone to come in and teach her how to use Appleworks and to get the students using technology. In the second placement, there was a negative attitude towards using the laptop in the classroom.

> I'm coming from a university that uses this thing regularly, this is my culture, this is my reference point. So anytime you can put a slideshow together like a PowerPoint, it's in colour, you can link it up to the Internet, you can show movies, you know whatever it is if you can use any instrument at your disposal. My thinking is use it. It's colour, its action, its motion, its engaging for the students. So I was bummed out. It was kind of frowned upon, you know, and particularly comments like 'My advisors coming, don't use PowerPoint in your presentation when she's here.'(Rhonda, 2007, interview)

Kathy also had a big difference in her two associate teachers in terms of experience with ICT. One associate teacher lacked ICT skills and Kathy had an opportunity to help her out. A reverse mentoring process ensued.

> My first placement my associate teacher didn't know how to use the computer. The only thing she had ever used before was email. So I gained a lot of experience because she had to do IEP's [Individual Education Plan, for special needs students]. So I actually got to help her fill out IEP's and fill out her report cards because she didn't know how to cut and paste. So she was just typing out everything and I was sitting there helping her, observing, but then I wasn't going to sit there for four hours. So I showed her how to do it. I think it was really beneficial to her and being able to do the computer lessons with the students. (Kathy, 2007, interview)

In Kathy's second placement, her associate teacher was the technology teacher and she used PowerPoint presentations and the students enjoyed it. Paul used his computer always for planning but not regularly in the classroom. The one time he used the PowerPoint, he had to bring out the projection screen from the back and it was awkward in the class as it was not set up to use a data projector. Stephanie used technology a lot on her placement. Neither of her associate teachers was knowledgeable about ICT but was willing to learn.

> The second placement I was at, a lot of the teachers were older, hitting retirement and really wanted to learn about computers but had no access to it. So I ran workshops after school for them for them to teach them different programs. They had one projector and one smart board in both schools and really didn't use them because they had only had 2 hours of training on the smart board. They had no idea besides being a glorified chalkboard what it could do, so we ran some workshops on that after school as well to try and encourage them to use it more. (Stephanie, 2007, interview)

Andrew had two really 'old' associate teachers who never used technology and rather than them becoming a resource, he became a resource to them. Within one of his classes he had a special needs student who was able to get a desktop computer to assist in his learning.

> In my last placement, my associate teacher wasn't too familiar with computers. We actually had a behaviour student who got not a laptop but a desktop computer from the government to help him learn, but because the teacher didn't really know too much about programs or anything available all the kid did was play video games all day online. As soon as I went in I started tinkering around and blocking all those sites and not only blocking the sites but putting in the favourites the appropriate websites he should be going to learn. Even though they're still games, they're still like learning games, and math games. (Andrew, 2007, interview)

Rhonda tried to incorporate ICT into her lessons by using PowerPoint presentations or showing movies through the data projector. She ran into difficulties due to the lack of technical support and lack of up to date computers in the school.

> I found that in both schools they had maybe 10 laptops and they'd be missing the backspace button, the space bar button, the batteries would be dead, and it would end up being 40 minutes of nothing but troubleshooting. The students would get absolutely nothing out of it because the computers weren't working properly. So I found it really frustrating having all this technology available to use and not being able to effectively use it within the schools because both of the schools, the laptops that they had were old school and broken. (Rhonda, 2007, interview)

One of the advantages that George stated was that he was so comfortable with computers after graduating that he felt confident that he could teach Introduction to Computers this fall at the grade 9 or 10 level.

> One of the advantages having used this laptop the whole year, I feel better. Now what I'm faced with this fall is that I might have to teach Intro to Computers. I'm not even still considered an STA student. I basically know how to turn it on, turn it off, but because I've used them so much I know more, like trouble shooting, what to do, not to panic. But now I feel better, like I'm tentatively scheduled to teach computers for grade 9 or grade 10 and I might have felt nervous before but

> now I don't, because I've used my laptop for 10 months, eight hours every day. (George, 2007, interview)

Sabrina learned that it was important to have a back-up plan. Sometimes the technology failed and if the PowerPoint which was wonderful but if it does not work one should have a back-up plan.

Sabrina stated that in the board she was in, the technology was well promoted, important and valued. Many of the teachers in her school did not have the time to learn about some of the technology and were very frustrated. Sabrina gave tutorials on some software after school for teachers who were interested. This would be another example of reverse mentoring.

In George's school, his associate teacher was 58, teaching for 30 years and often used ICT in his teaching at the elementary school. His associate teacher had all types of videos available in a variety of subjects. The students in the class were fully engaged in the lessons. George states it was different in the high school where there was limited ICT and it was difficult to sign out. Using ICT was not an easy process.

> For the high school, they had technology (data projector) available but the problem was it wasn't accessible. You could sign it out for a period and they were in the other side of the school. There's no elevator, so if you have to take a projector which is strapped to a cart, you need two individuals to carry it up the stairs and it can't be two students because of liability. And you can only sign it out for period at a time. (George, 2007, interview)

George noted that the students had varying degrees of experience in teaching with ICT depending on the skills of the teacher. "The other thing too is I noticed within that school in the math department they had a Smartboard but only one teacher knew how to use it so only certain kids were getting that Smartboard." (George, 2007, interview).

Fran noted the differences in a board such as Toronto where there are schools that have more resources and some that do not.

> I was in the Toronto board and I've yet to see or even hear of a school that has a Smartboard. That's the thing with Toronto, the board is so big you can have such varying degrees of resources and computer technology money. (Fran, 2007, interview)

Fran, who did her placement at the Primary Junior level, found that the use of the ICT in the classroom was mixed. Often it was used as an activity time or a reward for

good behaviour. If the preservice teachers were going to go out in the practicum and modeled the associate teachers they saw varying degrees of integration of ICT.

> My first classroom had four computers in it, my second had two. My first placement was grade 1/2 and computers are just activity time, the free time, the reward. They're big on 'Oh you've lost your computer time' and that's all the kids wanted to do…but they were still playing the math games so at least it was educational to a certain extent but it wasn't used constructively. They'd have one computer class period a week. We'd go up to the computer lab and a lot of them would get on the Kidpix and do art and all that. Then for my second placement there was one data projector for the whole school. (Fran, 2007, interview)

Cam did mention some of the frustrations of not being able to use the ICT in the schools due to limited resources.

> I noticed on planning and designing learning environments, it seemed like we we're doing great here like as learning how to use technology and do presentations and teach lessons with technology. Then I'd go on placement and they'd have no working TV's and no working projector systems and no working anything for technology to use. So I've learned how to use all this stuff, but they didn't teach me how to do it in terms of where I'd actually have to use it. So I had all this great knowledge that I could never use. (Cam, 2007, interview)

Lynn mentioned that, in the practice teaching report filled out by both the associate teacher and the faculty advisor, that there was a spot for technology. However, there was no definition for technology use or integration. There was a wide range of ICT use among schools.

> It could be I use a videotape because that's the most technology that school uses. But I could have gone to another place and ask for a VCR and they'd look at me like I had a third eye because they don't even have a VCR anymore because they're out of date. (Cam, 2007, interview)

Cam talked of his experience in starting a blog in a classroom about an Earth Day clean up. His associate teacher was not familiar with using technology but she agreed to let him do this. This was something that he created and did integrate technology across the curriculum of science, technology and media literacy.

> We were starting a class project and we were doing something about a big Earth Day clean up for about a week. So we started keeping a blog as a class, like we set up the blog and they were going to start their entries so they could get their writing. They're learning how to use technology and they do get a mark for that media literacy. So that was helping her out with her marks because she had no idea how to use technology in any capacity. So this was helping her out I was just

> able to show her these things. But for the most part the technologies I used were my own ideas. They were things that I was familiar with already and I didn't really use the stuff I was taught here (at the university) in the same way. (Cam, 2007, interview)

There was difficulty in the practicum as the preservice teachers did not have wireless Internet access in the schools in their practicum. However Cam found a way around this problem. He wanted to show a video clip from YouTube so he loaded up the Internet page at home the night before on his computer and did not shut his computer off. When he opened it up the next day in class he could use it but could not save the video from YouTube on to his laptop. He stated that although the ICT was great there are so many difficulties in trying to use it that it sometimes was not worth the amount of time involved. He would have something on his laptop and then he would be uncertain if the data projectors would be available for the class. There was no sign up sheet for the data projector so who ever got it first had it for that class. It was difficult to set a lesson around that uncertainty.

The preservice teachers when they were on their placement had some difficulty adjusting without the ICT. They learned how to teach using ICT and then when presented with a situation where they had to adapt only using the old technology.

> I did two high school placements and then a grade 7/8 and I struggled hard in the 7/8 placement because it was all hard copy resources, I had no electronic resources at all and nothing technological to help me along. So I had to do everything on my own. And I struggled a lot more with that because I was so used to using the technology all the time. But the students do love it [the ICT], it gets them into the lesson so that's the problem with that. (Cam, 2007, interview)

Patty, another preservice teacher, stated that none of her associate teachers used ICT in their classrooms. The teachers may have used an overhead projector but they were not into technology. Some of the ICT integration tools that Patty learned include using little video clips as an introduction to a lesson, PowerPoint presentations, web concept maps, searching the Internet and the creation of handouts for students. She did use a PowerPoint presentation while she was practice teaching but there was no Internet access in the classroom.

She found there was a lack of technology in the school where she did her practice teaching. In the high school, most classrooms did not have a data projector and it would have to be booked well ahead in advance. In the elementary school, there was only one

for the whole school and it was locked away in a room which required someone to go get it for her and then to put it back.

She taught a grade 8 science lesson with a PowerPoint presentation on cells where she showed the contraction of a muscle cell in a visual demonstration. She felt that it would have been very difficult to demonstrate that movement in any other way. Incorporating some animation into the PowerPoint, she felt was a good use of ICT.

The Dean, when asked if he felt the B.Ed. graduates are integrating ICT into their teaching once they are teaching in the classroom, stated that there was not enough data to determine this yet. He stated that many of the preservice teachers were by the end of the year so dependent on ICT, that they could not imagine teaching without ICT. He felt there was still 'a lot of big gaps' in the schools in regards to technological equipment. Some have data projectors and Smartboards but the availability of equipment may be holding some of the graduates back. School boards were hiring the graduates to be leaders in the schools.

The Dean described the importance of administrative support for an innovation that will be supported totally including financial resources and effective implementation strategies. If something is just partially supported then it will be difficult to build success.

> I think one of the most important things I learned as years go by, is the change theory. I think what's important to bring about change like adoption of something like this, I really think you have to have a clear administrative commitment and we've seen this in this innovation. If I'm ambivalent about it, it is going to be hard to build faculty support. So the same thing with almost anything you would come up with. I've seen a lot of administrators that get cut loose for something and you really are losing a very strong impetus to implement. I think the administration needs to look at it, the leaders need to look at it and think, 'Is this something I'm going to get behind totally and completely? I'm going to budget for and support publicly a claim or what we are doing.' And you need to do that or you're not going to have success. (Dean, 2007, interview)

If the goal of society is to adopt laptops as a learning tool then the support would have to go beyond the administration of the university. There are a number of external systems that would involve change. The ISTE standards and essential conditions necessary for implementing these standards would address the Dean's concerns and ensure a successful laptop program (UNESCO, 2002).

There is an opportunity for many but not all preservice teachers to integrate ICT in some of the schools. This inconsistency can be changed if the Ontario Ministry of Education changes policies and ensures that the essential conditions are met for all schools across Ontario. This would include that schools are resourced to support ICT and teachers are provided with professional development in ICT integration.

Rozanski (2002), in the Report of the Education Equality Task Force for Ontario, stated that the Ontario government created the Ontario Knowledge Network for Learning (OKNL) in 2000 to oversee a plan for integrating education and information and communication technology (ICT) for schools in Ontario. However, the OKNL has issued reports recommending a direction for ICT but little action has been taken by the government. Rozanski (2002) recommends that the government responds to the reports of the OKNL. He states that beyond the costs of hardware and software, "that there is a need for funding to train teachers in the effective use of ICT in teaching the curriculum and to hire the technical staff needed to support ICT initiatives" (p. 52).

## 4.8 Summary

Chapter four included: analyses of data from the online surveys completed by the faculty, and the interviews of seven faculty members, two technical assistants, four focus groups consisting of thirteen B.Ed. graduates, and the Dean. Comments from the interviews of the preservice teacher graduates supported the data collected from the faculty survey and interviews.

Data were organized into five main themes based on Rogers (2003) diffusion of innovations: the innovations used by faculty, the adoption and learning how to use the innovation, the organizational support of the adoption of the innovation, the unexpected consequence of the innovation and means to increase the adoption rate of the innovation. The analysis of preservice teachers practicum experience was used to determine if ICT skills and methods taught at the university were applied in the classroom. Many comments suggested methods to improve the integration of ICT into teaching.

Chapter Five discusses the research questions, suggests recommendations, discusses practical and theoretical implications, states the limitations, and suggests potential areas for further research.

# 5 Chapter 5 Discussion

## 5.1 Introduction

Chapter Five includes an overview of the research and a summary of the five research questions and recommendations. It also includes suggested solutions to the issues identified in Chapter Four. The practical implications acknowledge the similarities of the results from this study with those of previous studies. The theoretical implications identify how the adoption of laptop use in the classroom by faculty follows Roger's (1962) diffusion of innovations theory and the potential of future faculty development models for technology infusion. The limitations of the study are described as well as potential areas for future research, and a final summary.

## 5.2 Discussion of research questions

### 5.2.1 Question One:

**What ICT tools and methods are being used by Faculty of Education professors and how do they integrate ICT into their teaching?**

The computer is a multi-faceted tool comparable to a Swiss army knife where one person may often use a blade and another may prefer the corkscrew. Although the computer is often treated as a singular entity of ICT, there are many different applications both as software and on the Internet that have educational potential. Rogers (1995) separates ICT into two components: 1) hardware, the physical tool and 2) software, the information base for the tool. Some software, such as word processing, is considered an information and communication tool while other tools such as some games played on the computer may not. Rogers states that we often think of technology as being mainly the hardware which is a tool visibly easier to study but in fact, the software contains the information actually used and its processing by learners cannot be as easily observed. The laptop may be used differently depending on the subject area, and the ICT experiences of the faculty. The survey responses suggested there was variation in the kinds of software used, how it was used by faculty as well as the frequency of its use. The B.Ed. graduates indicated that they experienced considerable differences in how ICT was used by faculty in their teaching.

The detailed analysis of data from the survey and interviews in Chapter Four described some of those ICT used by faculty in their teaching. The survey listed 19

different self-rated ICT skills. This was not meant to be an exhaustive list, as interviews of faculty and preservice teachers, as well as looking at ICT integrated within the assignments, indicated there were many more kinds of ICT that were used in the B.Ed. program. It was determined from the survey that Faculty did have a high use of ICT in five out the six categories established by Russel et al.'s (2003). The faculty established their ICT use categories by, selecting from a Likert scale out of 5, the choices of: Never, Rarely, Sometimes, Often, and Very Often. The findings, where ICT use category is listed followed by the mean score out of 5 in brackets, were: lesson preparation (4.8), lesson implementation (4.5), assessment (4.4), communication with preservice teachers (4.4), and use of ICT by preservice teachers in class (4.2). Fewer faculty members used ICT in the area of special education (2.6).

Following the same Likert scale, faculty indicated their most used ICT functions that was integrated into their teaching, determined by the mean out of 5 in brackets, were: 1) Internet to retrieve information (4.4), presentation software (4.3), word processing, (4.0), and email (3.9). External ICT tools such as Smartboard (1.6) and GPS (1.5) were used by some faculty but overall rarely used. The synchronous chat (MSN) was the least integrated (1.5). Much of the software on the computer would be division or subject specific (e.g. math) and not used by all faculty.

Interviews with B.Ed. graduates indicate that, although they were often shown how to use ICT in teaching in a lecture format, they did not always have the opportunity to use or time to master the use of ICT. Tools often require some practice and time to gain fluency (Urbain-Lurain, 2000). Some B.Ed. graduates lamented that they were not having ICT modeled as it would be used in a classroom. The lack of modeling by faculty was also mentioned in a study by Stewart (2003).

Embedding the use of ICT into an assignment was one method of ensuring integration requiring the preservice teachers to utilize the software. The faculty in the survey listed many assignments that required preservice teachers to use ICT. Many of the faculty had numerous assignments requiring ICT and the entire faculty who answered the survey had at least one assignment requiring the use of ICT.

Interviews of B.Ed. graduates indicate that although ICT was readily utilized in the B.Ed. program, there was variation in use among faculty, a finding consistent from

other studies (Bin-Taleb, 2005; McKimmy & Leong, 2006). Preservice teachers' comments indicate that some of the faculty required continued assistance from preservice teachers or STA's in use of the laptop. Some professors continually asked for laptops to be shut down during class time. As well, the preservice teachers stated that they did learn how to integrate technology into teaching from some professors. The preservice teachers indicate that some professors expressed mixed feelings on the benefits of ICT in the classroom which could influence the frequency of ICT use in their future teaching.

### 5.2.2 Question Two:

**How do Faculty of Education professors perceive they are learning how to integrate ICT into their teaching? What kinds of faculty development do they receive?**

From the survey, it was determined that most faculty members indicated they were increasing their competency in ICT skills, since they started teaching at the university. Although, an increased personal skill level does not necessarily signify there was more ICT integrated into teaching. Faculty were asked in the survey to rate their skill level on 19 different ICT skills prior to teaching at the university and at the time when the survey was given in 2007. There was growth in every skill with the overall mean increasing from 2.5 to 3.2 out of a possible 5.0, indicating that ICT learning was occurring among faculty. A self assessment of skills leaves room for a wide variation among faculty where growth may be marginal for some ICT skills and higher for others. The lack of ICT standards for faculty makes it difficult to determine the actual level of ICT competency. A more accurate measure of ICT skills could be determined by an objective test or the use of the recent ICT-CST Competency Standards Modules (UNESCO, 2008). Guskey (2000) suggests that, after professional development exercises, an evaluation is appropriate to determine if learning has occurred.

Further questions examined how they perceived their learning was occurring. Their responses suggested faculty members were learning about ICT integration mostly on their own and from colleagues. Kariuki and Knaack (2003) recognized collaboration among faculty as a method of learning and teaching ICT. Some faculty who worked closely with others may have developed a community of practice supporting their ICT integration skills (Wenger, 2008).

To a lesser extent, professors learned from preservice teachers (reverse mentoring), student technical assistants (STAs), and technical assistants where one-on-one support was available if needed. However, it was stated by the B.Ed. graduates that some faculty regularly required the assistance of the STA. Some additional learning occurred through computer courses and prior school board professional development activities. The survey further indicated that very little learning originated from conferences and associate teachers in the field. This lack of communication between faculty and associate teachers may indicate the professors do not regularly enter the schools, or there is a lack of ICT being integrated in the classroom. However, studies indicate that it is possible to establish successful faculty development research in partnership teams with schools and Faculties of Education (Judge & O'Bannon, 2008).

The faculty development offered by the institution was ranked low as a method of learning, and in recent years it consisted of a few sporadic workshops that were not well attended. Recently hired faculty indicated that they had more difficulty in learning how to integrate ICT into their teaching. There were more professional development workshops initially offered when the laptop program started, in 2002, but less once the laptop program was established. The new faculty indicated that they received little or no training with ICT integration. Teaching in a new institution, coupled with the laptop as the expected teaching tool, presented a high learning curve for incoming faculty. Some newly hired professors did not receive their laptop until after the preservice teachers, which added to the anxiety of teaching in a new institution. The UNESCO (2002) document suggests that if faculty development is to be effective, it must involve planning and support from people at all levels including the government, the universities, the professional associations to set ICT standards, as well as schools. Pan (2000) suggests that inadequate faculty development is one of five main obstacles that inhibit the integration of ICT into teacher education programs. Barriers impacting ICT integration can be addressed with professional development (Brinkeroff, 2006). It has been suggested that universities with laptop programs provide faculty development to professors to learn ICT skills, as well as model how to teach in a ubiquitous computing environment (Brown, 2000; Ellis, 2004).

The Dean recognized faculty turnover as a concern, stating that newly hired faculty required 2-3 years of in-servicing to be effective at integrating ICT into teaching. As well, he estimated these recently hired professors did not experience the same 'thought process of adoption' of the new technology as the existing faculty. However, in contradiction, the newly hired faculty indicated they had very little in-servicing, and desired more ICT learning opportunities. Brinkeroff (2006) suggests that faculty development can address the concerns of lack of training and experience and to some degree attitude towards ICT. The recommendation for more faculty development has been noted in other studies of ubiquitous computing Faculties of Education including Acadia University (Cook, Bobbitt, Cunningham Hartman, & Hodder, 2006), and Nipissing University (Stewart, 2003).

It was surprising that most of the faculty indicated that they did not speak to the Dean about the integration of ICT. It could be expected that the Dean would lead by example with ICT integration, however it seems that faculty looked toward their colleagues. The Dean was not asked to complete the survey to rank his ICT skills or to establish how he learned his ICT skills. It would be expected that the Dean would have similar concerns as faculty in learning ICT, and would not have had the opportunity to experience teaching using ICT since he has been in administration for some time.

Faculty development has consisted mainly of sporadic workshops, which had gone down in frequency since the startup of the laptop program. The technical assistant and student technical assistants were available to help faculty when needed.

In summary, faculty indicated they were learning how to integrate ICT into their teaching mainly learning on their own and through colleagues. There has been little faculty development especially for recently hired professors. A review of the literature indicated that formalized faculty development initiatives would increase ICT learning and integration into teaching (UNESCO, 2004; ISTE NETS, 2004).

### 5.2.3 Question Three:

**How does the professional environment support practices of professors' integration of ICT into preservice teaching at the university?**

The Essential Conditions For Teacher Preparation (ISTE, 2004) are established guidelines to foster successful integration of ICT into teaching environments. The ten headings for the Essential Conditions are: shared vision, access, skilled educators, professional development, technical assistance, content standards and curriculum resources, student centered learning, assessment, community and support policies (ISTE, 2004). Despite the lack of familiarity of the ISTE standards by 71% of the faculty, the professional environment, in general, did embrace some of the essential conditions.

Brief comments on how the University supported the main Essential Conditions (ISTE, 2004) (in single quotations) are described. There is a 'shared vision' and support from administration. The Dean was familiar with the ISTE standards as well as the computer professor and an effort was made to establish a successful laptop program. However, initial studies by Stewart (2003) indicated there was a lack of overall vision. The B.Ed. graduates indicated that there was a wide variation in attitude towards ICT integration among the faculty.

The faculty and preservice teachers have 'access' to the current technologies, including a laptop, OSAPAC software and wireless Internet. However, the access was hampered by technical difficulties such as email down and Internet outages.

It cannot be assumed that members of the faculty are 'skilled educators' in ICT with practical teaching experience in the field. There is a wide range of variation in terms of ICT expertise. Only three of the faculty identified themselves at the inventive stage in the ACoT self assessment in confidence and skills in technology. The majority were at the adaption and appropriation stages.

'Professional development', although offered occasionally and attended rarely, exists. There was one on one help available with technical assistants. The technical assistants felt this was an effective method of assisting professors. Considering the potential benefits of faculty development and the wealth of literature on various implementation methods, the university falls short in meeting this Essential Condition.

The 'technical assistance' came from preservice teachers who were student technical assistants (STA), technical assistants and University Technical Services. Despite this support, faculty and preservice teachers complained about basic

requirements for integrating ICT into teaching, including slow wireless Internet speed and reliable email access.

The professors were knowledgeable in their respective 'content standards and curriculum resources'. Neither the ISTE, nor any other ICT standards, were supported in Ontario or at the university. This lack of systematicity in expectations was reflected in the findings that faculty members were knowledgeable in their subject area, but some may not have the expertise in the integration of ICT.

'Student-Centered Learning' may be taught within the classes of some professors. However the opportunity for practicing ICT integration in the schools was inconsistent due to lack of ICT resources and the variation of associate teacher ICT skills in most schools. In 'assessment', there was no evidence of continual assessment in the effectiveness of the technology for learning. Faculty had at least one assignment that integrated ICT. The computer course had several assignments specifically integrating ICT.

The 'community' does provide some support. The university provided the technical infrastructure to support the laptop program. However outside of the university, not all schools are equipped to provide the opportunities for full ICT integration in the classroom. From comments of preservice teachers, there existed a wide range of ICT skills among associate teachers and faculty advisors which provided preservice teachers either a rich or poor ICT teaching experience depending on the technological experience of the associate teachers and the ICT resources of the school.

The 'support policies' of the Ontario Ministry of Education curriculum, Ontario College of Teachers and the Faculty of Education's conceptual framework encourage the use of ICT but do not provide full support through resources or standards for the integration of ICT into teaching. If the Essential Conditions are used as a guide to measure the professional environment, it falls short in many areas.

Professional environment includes both the structural and human environment. In terms of physical environment the university provided laptops to all professors and required all preservice teachers to enter into a lease-to-own contract. The university had a wireless system throughout the university as well as access to electricity within the B.Ed.

classrooms with electrical outlets and extension cords. University Technical Services took care of all laptop concerns.

There were concerns raised by both faculty and the preservice teachers of the speed of the wireless service since synchronous logging slowed access. For example, the computer professor did not use the Internet in his teaching as he felt it was unreliable and slow. This was a concern as he felt the computer course should demonstrate and model use of the Internet as an important educational resource. There were also concerns about the size and design logistics of the classroom as it was difficult to move around the classroom with 40 B.Ed. students using laptops which are plugged into electrical outlets. This created difficulties for faculty who attempted to model classroom pedagogical practices.

The professional environment also included people who interacted with the faculty. The professors discussed ICT mainly with their colleagues, preservice teachers, family and friends. There was less discussion with colleagues outside the faculty, or with Student Technical Assistants, the technical assistant, associate teachers and the administration. A community of practice could be considered the learning environment for some professors.

### 5.2.4 Question Four:

**What are the issues that hinder the Faculty of Education professors when integrating ICT into their preservice teaching?**

The main issues included: a) off task behavior; b) wide range of ICT skills among preservice teachers; c) wide range of ICT skills among faculty d) faculty attitude toward ICT integration, e) technical difficulties; f) lack of time; g) cost of laptop; and h) OSAPAC software. Recommendations are also listed when possible.

#### 5.2.4.1 Off-task behaviour

The laptop can be a wonderful distraction to any student sitting in a class. It was easy to appear quietly engaged in the lesson if the teacher cannot see the computer screen. Off-task behavior was mentioned as a concern by both faculty and preservice teachers. It has also been mentioned in other ubiquitous laptop teacher education programs (Scott, 2005; Bin-Taleb, 2005: Leong & McKimmy, 2006). Kay (2006) mentions that there is a time for the laptop screens to go down. Some faculty treated off-

task behavior on the laptop as a classroom management issue and encouraged the preservice teachers to stay on task, modeling effective teaching strategies. Other faculty allowed the preservice teacher to do what they wanted on the laptop, stating that they were adults and can behave as they want. Allowing some preservice teachers to exhibit off task behavior disturbed other preservice teachers in the class who wanted to learn. Off-task behavior will continually be a concern for anyone teaching in a ubiquitous laptop environment. Classroom management has always been a concern in any teaching environment and teacher education programs should model it effectively.

#### 5.2.4.2 Wide range of ICT skills among preservice teachers

Faculty and B.Ed. graduate interviews comments indicated there were a wide range of ICT skills among preservice teachers entering the B.Ed. program. Preservice teachers who had a high level of ICT expertise shared their knowledge and skills with other preservice teachers, faculty and associate teachers. However, preservice teachers who had weaker ICT skills made it more difficult for faculty to deliver a lesson that required a certain level of ICT competency. This created challenges for faculty teaching to the average skill level of the class because some of the high skill level preservice teachers could have been bored while the lower skill level preservice teachers were frustrated. In addition, strategies such as a pre-entry diagnostic test to determine the computer proficiency of the preservice teachers or advance notice to preservice teachers indicating the ICT skills expected for the B.Ed. program were not in place.

#### 5.2.4.3 Wide range of ICT skills among faculty

Interviews of B.Ed. graduates found evidence that some faculty actively modeled ICT integration and others did not. For example, pre-service teachers took the same math course from different professors who taught math. The preservice teachers commented that one professor expected the laptops to be down throughout the whole course except for 20 minutes of one class where math software was demonstrated. Another group of pre-service teachers indicated the math teacher regularly integrated ICT into his teaching perhaps too quickly, not giving enough time to learn how to use the many examples of software available. Comments also indicate that some of the part-time professors with teachable subjects at the Intermediate Senior level did not utilize ICT regularly in their teaching compared to full time professors. The preservice teachers describe how they had

to continually assist some professors who were struggling with ICT. The survey and interviews indicated the existence of a wide range of ICT skills among faculty creating an inequitable learning environment for preservice teachers.

From the interviews, Irene, a professor who indicated that she was skilled in ICT, described how she seamlessly integrated ICT into her lessons. Aimee, a professor who used a PowerPoint for the first time in her interview for the position at the faculty, struggled with learning ICT. It is more likely that a professor who has a higher confidence level of using ICT, would be more proficient at using the computer, and therefore better able to teach the skills that could be shared with preservice teachers.

Further evidence of variation among faculty was derived from the faculty survey where they self ranked their skill and confidence levels in using ICT according to ACoT levels. There were no professors at the entry stage where educators struggled to learn the basics of technology. At the adoption stage, there were 13.89%, where educators move from the initial struggles to successful use in technology on a basic level. There was the highest percentage at the adaption stage, 41.67%, where educators move from the basic use of technology to discovery of its potential for increased productivity. Only 36.11% were at the appropriation stage, where they had achieved mastery over technology, using it effortlessly as a tool to accomplish a variety of instructional and management goals. Only three of the thirty-seven professors who completed the survey, 8.33%, rated themselves at the invention stage, where educators are prepared to develop entirely new learning environments that utilize technology as a flexible teaching and learning tool. They began to think with the technology, designing new ways to solve learning problems that their students may have faced in the past (CEO Forum on Education and Technology, 2000). Since the computer was a new tool, the variation in confidence and skill levels of professors was considered acceptable. However, if one were to make comparisons to other tools, such as the use of a musical instrument, higher levels of proficiency would be expected from a professor.

Many people could pick up a guitar for first time and make a sound or possibly music. Although the computer is a different tool, a general analogy could be made in their comparison of learning. It usually takes months of practice before one could become competent at playing the guitar. The more time spent practicing with the guitar, the more

skilled one would become. It would take possibly years of practice and perhaps lessons from an experienced teacher before one could be considered skilled at playing the guitar. It may take a longer time and additional training in music before someone could start creating songs with the instrument, which could be categorized at the inventive level. It could be argued that it would be possible for someone without experience to pick up a guitar and start teaching others how to play, however, both the learner and the teacher would probably be limited in their scope of what they could accomplish. In my opinion, a professional experienced guitar teacher could be expected to be at or above the mastery level, which according to the ACoT, is the appropriation or inventive level.

Other examples of information and communication tools that require practice as well as teaching include language, reading and writing. Vygotsky (1978) considered language a tool where proficiency increases with both practice and teaching. Reading and writing are also tools that have improved proficiency with increased frequency of use and effective teachers (International Reading Association, 2002). One would expect all the professors to be at the mastery level in reading and writing in order to teach, and although they were not asked to evaluate themselves in that manner in this study, arguably, most people with a university degree would be at the appropriation or inventive level. In this study, less than half, 44%, were at the appropriation and inventive stage in confidence and skill in using ICT. At a Faculty of Education, the expectation would be that the preservice teacher would be learning from the professor, although in this case, professors were often learning from the preservice teacher.

This variation in the ICT skill level of the professors has many potential causes. Many of the professors who were new to the university had less time to work with the laptop and did not experience the limited workshops that were available to the professors at the inception of the program. In contrast, the professors who have taught with the laptop since the beginning have had a longer period of time to gain experience, mainly on their own but also learning from others. As well, professors have lacked faculty development and incentives to learn and integrate ICT.

The Dean mentioned the difficulty newly hired faculty experienced as they had not been involved in the thought process involved in accepting the innovation of the laptop, but rather arrived and found this an existing condition to which they had to adapt.

The various stages of acceptance of ICT by faculty may be conceptualized following Rogers' (1995) innovative-decision process which is described in more detail within the theoretical implications. Rogers (1995) describes how many innovations are adopted by organizations with the decision being made by the authority, who possessed the power, status or technical expertise. Although the laptop was accepted by the university as a tool requirement by both faculty and preservice teachers, the actual use of ICT in the classroom was dependant on the individual professor.

It is generally expected that a technological innovation introduced into a system provides some advantage for those who adopt the new tool. However, the benefits are not always obvious to the intended adopters. They are never certain that the innovation is a going to be better than the previous practice that it might replace (Rogers, 1995). Some Faculty of Education professors appeared to fall into this category of reluctant adopters of new technology. Their reluctance to adopt may be amplified because of their lack of personal experience, both success and failures, in using the technology themselves teaching in a regular classroom. Faculty of Education professors might have been confident in teaching others about their successes when they were in the K-12 classroom, yet the technology has changed so quickly that it was not such a focus at that time. This lack of knowledge would rarely be solved as once a teacher became a Faculty of Education professor. It is unlikely that they would go back into a regular classroom to gain that personal evaluation experience of success or failure of the technology at the school level.

Although the university has adopted the laptop program, the faculty members were in various stages of acceptance in the innovative-decision process. The preservice teachers in their comments report that a few faculty members did not use the laptops in the class and often wanted the laptops to be shut down to avoid the distraction they would bring. Nevertheless, the majority of the professors had accepted the computer's classroom presence and they were integrating ICT to some degree into their teaching.

The computer is also a tool that requires a certain amount of skill and experience to become proficient in its use and to maximize its benefits (Urbain-Lurain, 2000). If the university provided the opportunities for professors to attain a proficient level of ICT, this could provide a more equitable learning experience and increase benefit to preservice

teachers. Preservice teachers would benefit from the faculty with a high level of ICT expertise, yet there was a potential for lost ICT teaching experiences when they were taught by faculty who lacked ICT teaching skills. Ultimately, this variance among faculty expertise can create an inequitable learning experience among preservice teachers.

#### 5.2.4.4 Faculty attitude toward ICT integration

All faculty members who completed the survey indicated that they integrated ICT into their teaching to some degree. All course outlines analyzed had at least one assignment requiring ICT use. However, it was surprising to discover from the interviews of the B.Ed. graduates that some faculty did not integrate ICT into their teaching at all and continually asked to have the laptops down in class.

Although some faculty lacked the ICT skills, they still gave positive responses when asked about using ICT and used it within their teaching hoping to learn along with the preservice teachers. There were other faculty members who chose not to use ICT in their teaching and had a negative attitude towards technology. This dichotomy gave preservice teachers mixed messages in the use of ICT according to B.Ed. graduate comments. Some professors were very much in favour of integrating ICT into their teaching and others were not.

It was uncertain if the negative attitude of some faculty toward the laptop was because of lack of skills or because of a different pedagogical view. While faculty may have provided the preservice teachers the tools to teach in the classroom, many schools would not have supportive ICT infrastructure due to the lack of provincial ICT standards and funding. Therefore, teaching ICT integration to preservice teachers may not appear to be useful because the opportunity to practice these skills in a school is limited.

The professor in teaching the class may or may not have used ICT in their teaching depending on the appropriateness of the situation. The reasons for not using ICT could be that it was not the best tool to teach a particular concept. It would not be expected that ICT be integrated into every lesson just for the sake of using ICT (Bin-Taleb, 2005). The physical education teacher once said, “These laptops are great but they do not dribble as well as a basketball.”

#### 5.2.4.5 Technical difficulties

There were a number of technical difficulties that occurred throughout the year with the laptops and supporting infrastructure. The laptop computers often crashed or froze. The initial replacement of batteries on the Toshiba laptops created frustration for preservice teachers which may have had an impact on their attitude towards technology. This was an example of an issue where the introduction of the new tool, the laptop, required some adjustment of the existing infrastructure. This issue is similar to Cuban's (1986) concerns about the technical difficulties teachers experience when a new machine is introduced to teachers in the classroom.

The email outages often created communication difficulties among faculty and also between faculty and preservice teachers. This was another external factor that caused perturbation and the email provider continued to attempt to correct the problem. The wireless Internet was often either slow or not working. In a laptop program where access to the Internet was often used for accessing resources and communication it was crucial to have these resources working. The net result was that the computer professor failed to use the Internet on a regular basis in his class as it was not dependable and was often slow. This concern was previously raised by Cuban (1986), where a technology is not accessible and dependable it will be used less frequently.

The technical infrastructure to support ICT within the B.Ed. program has been established but lacks dependability. Resources could be allocated to maintain a higher and more consistent level of reliability. The success of the program involves planning, prevention and maintenance. Early experiences that result in failure of ICT would discourage continued use (Cuban, 1986). Frustration sets in easily when the technology cannot be depended upon.

#### 5.2.4.6 Time management

Lack of time for learning and integrating ICT has been noted in many studies (Lim, 1999; Stewart, 2003; Thompson, Schmidt & Davis, 2003; Wicker & Boyd, 2003; Scott, 2005; Resta, 2008). The time spent in learning how to use software was not recognized in the tenure process (Scott, 2005). Time management can be an individual choice and therefore can be subjective. Faculty stated that it took time to learn how to use

software, for example, when Joan expressed a wish that she had more time to learn how to use the Smartboard.

In interviews, the preservice teachers lamented that computer programs were demonstrated but they did not have an opportunity to use the software during class time. This lack of time meant that the modeling of the teaching of software was shortened to a quick viewing.

The B.Ed. graduates suggested that there was so much material to learn that the consecutive B.Ed. program could benefit in being extended to a two year program. At the present time, in Ontario, most consecutive B.Ed. programs were 8 months long. There was a two year B.Ed. program that also included a Master of Teaching at OISE/UT as well as many 4 and 5 year concurrent B.Ed. programs. The rest of Canada and the United states have B.Ed. programs of 2 years or more.

#### 5.2.4.7 Cost of laptop

The cost of laptop was a concern of preservice teachers in studies by Rader (2005) and Bin-Taleb (2005). These concerns were also raised at the university as the purchase price of the laptop and software, including the technology fees was significantly higher than the price of the same laptop in the local computer store, once classes had started. This price discrepancy created bitterness in some preservice teachers towards the use of technology. Giving preservice teachers an option to purchase their own laptop (with minimum specifications) elsewhere could remove some of the resentment toward the university among those that did complain about the cost. Cuban (1986) recognized that new machines may engage students more but the unit costs make the purchase prohibitive compared to alternatives. As laptop prices continue to decline, the concern of purchase price may become less of an issue in the future.

Possible solutions to this issue include finding a laptop provider that would guarantee that the retail price of the laptop would remain higher for most of the school year than the early tender price that the university paid for the computers. Another potential solution is that preservice teachers could purchase their own laptop with a minimum set of specifications prior to coming to the university. Requiring the preservice teachers to purchase laptops outside the Faculty of Education would also eliminate the difficulties with sales and maintenance that the university experienced.

"When the price of a product decreases dramatically during a diffusion process a rapid rate of adoption is facilitated." (Rogers, 1983, p. 214). Economics has a large influence over the adoption of innovations. If an innovation is too expensive, it will not be adopted as quickly as one that is less expensive. In the university context the cost of the laptop had less of an influence over the direct use of the laptops by faculty as the computers were purchased by the university and preservice teachers were required to purchase the laptops prior to entering the B.Ed. program.

There was a cost to the university in maintaining the supporting infrastructure such as wireless, classroom setups with electrical outlets, and technical support staff. The university, although it was supportive of the technological infrastructure, experienced frequent breakdowns of email and wireless. Assuming there is a desire for more ICT in education within the schools the lower cost of technology and its supporting infrastructure would hasten its adoption. If the preservice teachers are to have an authentic teaching experience using ICT in their practicum, the schools require a supportive teaching environment.

The software was also an expense for the preservice teacher and the university. The commercial software licenses were only good for the one year. The OSAPAC software is only available to Ontario educational institutions and employees. Open source software could be explored as an option. There is a ubiquitous laptop high school in Northern Ontario that uses open source software with all the students (Personal communication, 2007). This has saved the school from purchasing commercial software. However, the students of the school cannot use the OSAPAC software on their laptops because they are not employees of the school board. Any Ontario school that has their students use their own laptops unfortunately is restricted from downloading the OSAPAC software. Open source software is becoming an inexpensive and viable alternative.

In an ideal situation, the government would recognize the potential long-term societal value of ubiquitous computing and provide all students, teachers, preservice teachers and teacher educators with some kind of portable technology. Future studies examining the benefits of government interventions, such as the one in Maine, where laptops were provided broadly to students and teachers (Papert, 2001), may help to encourage this practice be taken up in Canada.

#### 5.2.4.8 OSAPAC software

Through interviews, it was determined that the preservice teachers resented paying the cost of having all of the software on the computer, not using most of it and then having it wiped off at the end of the year. The software removal from the laptop involved many external systems. It involved the Ontario Ministry of Education, who arranges for licensing for OSAPAC (Ontario Software Acquisition Program Advisory Committee) software and the businesses who own the software. Their set of rules comprised the license contract between the schools, the teachers and the faculties of education. The agreement allowed only employees of educational institutions to download software, unfortunately, preservice teachers are not yet employed. All teachers would benefit in having an opportunity to use and practice the software outside the schools setting.

### 5.2.5 Question Five and Recommendations:

**What changes to the B.Ed. program would facilitate Faculty of Education professors' integration of ICT into their teaching?**

The answer to this question was expanded to include recommendations in addition to those previously addressed as issues in Question 4. The recommendations include: providing effective faculty development, adopting ICT standards province wide, adopting ICT standards at the university, and having faculty advisors with ICT skills and experience. These recommendations will be further discussed in practical and theoretical implications.

#### 5.2.5.1 Increased effective faculty development

Effective faculty development would encourage the modeling of ICT integration. Faculty development oriented to new faculty (Lim, 1999) would be beneficial as well as immediately receiving the laptop upon hiring (and not after the preservice teachers receive theirs). There were a number of specific practical suggestions by faculty listed from the survey to increase the facilitation of ICT integration. These were listed in detail in Chapter Four and include faculty mentoring, more workshops, mandatory rather than optional workshops (Ellis, 2004); ICT courses, incentives (Harvey – Beavis, 2003), decreased teaching load, help websites, visits to model ICT schools, more time provided for faculty to learn ICT proficiency (Lim, 1999; Stewart, 2003; Thompson, Schmidt, &

Davis, 2003; Wicker & Boyd, 2003; Scott, 2005; Resta, 2008), and regular faculty development (Stewart, 2003; Thompson et al., 2003). The literature suggested a wealth of proven examples of effective faculty development strategies including following the UNESCO model of ICT in teacher education (UNESCO, 2002), or the ImPACT model of faculty development (Judge & O'Bannon, 2008) that offered a variety of strategies. Most of the literature around faculty development is based in the United States in response to the implementation of the ISTE NETS, adopted by NCATE, and supported through PT3 funding.

Workshops that were offered rarely and attended sporadically appear to be the main faculty development that occurs. There was technical support provided by technical assistants and STAs. Other kinds of faculty development models suggested by Guskey (2000) include large group presentations, discussions, seminars, role-playing, simulations, and micro-teaching. Being observed and receiving feedback is a valuable method of professional development (Guskey, 2000) which was not mentioned by faculty other than preservice teacher course evaluations. Study groups that facilitate curricular innovations would be appropriate in implementing new teaching innovations. The inquiry/action research model can approach problems of ICT integration as a method of professional development. Systemic models of ongoing professional development are more effective than isolated training such as periodic workshops (Guskey, 2000).

#### 5.2.5.2 Adopting ICT standards province wide

The single greatest factor that would influence the integration of ICT into teaching would be the adoption of ICT standards into education province wide, such as the ISTE standards, which would require students, teachers, teacher educators and administrators to have the basic technology skills and utilize ICT in teaching. This adoption of ISTE standards can only be accomplished through changes by the Ontario government. The present policy of encouragement of ICT use tends to unwittingly create a digital divide where some people have more of an opportunity to learn ICT skills than others because of the variation of educational experiences among educational institutions. Adopting ICT standards was previously mentioned by Weeks and Kariuki (2003) and van Woudenberg (2005) as being critical for effective change. If ICT standards were adopted province wide, it should be done nationally as well to prevent disparity among provinces.

The United Nations through their UNESCO (2002) document suggests the benefits of ICT literacy and the need for the support of the Essential Conditions (ISTE, 2004).

If ICT standards are established within schools, this creates a motive for teacher educators to acquire a minimum standard of ICT skills and to prepare preservice teachers to teach at or exceed this level. It would also require associate teachers to model ICT integration at the school level and to provide authentic classroom experiences for preservice teachers in order to practice teaching ICT integration for themselves.

Evans (2006) used a survey instrument, Technology Integration Survey (TIS) designed to measure the technology integration skills in preservice teachers. The survey was based on the ISTE NETS for teachers and was used by preservice teachers at the University of North Carolina. The study proved that TIS was a viable tool used to measure technology integration skills of pre-service teachers. An instrument such as this could ensure that B.Ed. graduates have a minimum level of ICT proficiency. A comment by one of the B.Ed. graduates indicated that some preservice teachers are not concerned about learning ICT since it is not formally evaluated. Any additional workshops they attended were beneficial but voluntary. Having ICT standards for educators would ensure a minimum level of ICT competency of B.Ed. graduates.

#### 5.2.5.3 Adopting ICT standards at the university

The adoption of the ISTE standards at the Faculty of Education would help ensure all faculty members would be cognizant of ICT standards in their teaching. The preservice teachers were taught about the ISTE standards in their computer course and were required to complete an assignment analyzing a lesson taught using the ISTE NETS as a guide. However, the survey indicated that 71% of the faculty was unaware of the ISTE standards. A method of educating faculty about the value of the ISTE standards could be established through faculty development. Presently, there are no extrinsic motivators for faculty to increase their level of ICT skills or knowledge.

#### 5.2.5.4 Faculty advisors

Faculty advisors supervised the preservice teachers during their field experience. They formally evaluated preservice teacher lessons at least twice during the year. This role in the past has previously been a faculty responsibility but, with the expansion of the B.Ed. program over the last number of years, very few of the faculty advisors actually

teach in the B.Ed. program. The majority are now retired principals or teachers hired part-time to do practicum visits. These part-time faculty advisors were not supplied with laptops nor were they given any training to determine how to evaluate effective ICT integration in a lesson. Although the concern of faculty advisors did not arise from the data gathering, the author would recommend that they have a established level of ICT integration skills to counsel preservice teachers on how to integrate ICT within their lessons.

### 5.3 Practical implications

Some of the practical implications of this study go beyond the recommendations in Question 5. They include informing the Faculty of Education at the university about the findings of this study which may be used to improve the integration of ICT into teaching within the program. Faculty responses from the survey suggested both areas of possible ICT interest and effective ways of providing that experience.

Many of the findings of a previous study at this university (Stewart, 2003) remained the same even after five years. There continued to be a lack of organized faculty development, and the few workshops that were offered were poorly attended. Technical difficulties such as email outages and slow Internet connections continued to be frustrating for faculty and preservice teachers. The changes that did exist indicated that there is some emerging collaboration among faculty, supporting study findings of Kariuki and Knaack (2003). One of the primary methods of ICT skills acquisition is the discussion and interaction with colleagues which is consistent with Kariuki and Knaack (2003). The technical support continued to be available for faculty and preservice teachers through STA's and technical assistants. Stewart's (2003) claim of a lack of vision for the laptop program was not addressed directly within this study. The survey from this study indicated that most of the faculty was integrating ICT into their teaching and have increased their ICT skills since beginning hired to teach at the university.

The recommendation that the ISTE standards become part of the university curriculum was made by Weeks and Kariuki (2003), and was still not in place as of 2009. The lack of ISTE or any other standards can result in a lack of an authentic ICT classroom learning experience for some preservice teachers in the practicum. It was difficult to reinforce the ICT teaching experience modeled by some professors in the

Faculty of Education if the authentic opportunity to practice teach with ICT did not exist in the real classroom (Weeks, 2004). In fact, with the increasing ICT skills of younger students, occasionally a reverse mentoring process was created, where preservice teachers were sharing their ICT skills by giving workshops to teachers in the field and assisting associate teachers who saw the benefits in teaching with ICT.

There were a number of different teaching strategies incorporating ICT described briefly by faculty in the survey and through interviews. An example of a creative use of ICT integration described in the literature were video case documentaries developed at University of Ontario Institute of Technology (UOIT) in the teaching of argumentation skills in a science class. This was a virtual entry into an actual classroom through the use of ICT (vanOostveen, Hunter, Kay, & Muirhead, 2007). The availability of proven examples of innovative teaching strategies could benefit both faculty and preservice teachers at many Faculties of Education. Although the vanOostveen et al. (2007) article was published in a journal, other methods of sharing this information such as online repositories or perhaps informing faculty through professional development would be worthwhile.

This study and the Resta (2008) article were similar enough that it is worthwhile to distinguish the similarities and differences. Resta (2008) examined the overall implementation process of a laptop initiative at the University of Texas at Austin College of Education where as this study focused on the faculty experience. Both studies recognized the complex nature involved in teacher education as it was difficult to study a single component in absolute isolation. Viewpoints of administration, preservice teachers, technical assistants, schools, students, and governments all have an influence on each other within a study.

The educational institutions were similar in that both started their ubiquitous laptop program in 2002 with this university electing to use a PC computer (initially IBM) and the University of Texas at Austin chose to use the Apple model. Many colleges and universities went with full computer ubiquity while in both these cases only the Faculties of Education chose computer ubiquity while the rest of the university did not (Resta, 2008).

This study also differed in that the United States, including Texas, have adopted the International Society for Technology in Education (ISTE) National Educational Technology Standards (NETS) which are set for students, teachers, administrators and teacher educators (ISTE NETS, 2008). In Ontario, where this study was conducted, there were no universal ICT standards comparable to the National Council of Accreditation for Teacher Education (NCATE, 2007) which has adopted the ISTE NETS. The similar accrediting body, the Ontario College of Teachers (OCT) had 'suggestions' for using technology rather than standards (OCT, 2008). As of 2009, there are no universal ICT standards for schools within the Ontario curriculum, other than a technology and a business course at the high school level (Ontario Ministry of Education, 1999, 2006). Implementing a ubiquitous laptop teacher education program in the Ontario educational system where ICT integration is only recommended provided additional challenges compared to the American system where it is expected.

The Ontario College of Teachers' (OCT) Foundation of Professional Practice includes the Ethical Standards for the Teaching Profession and the Standards of Practice for the Teaching Profession (Ontario College of Teachers, 2008). The only recognition of technology occurred in the revised 2008 OCT document where it was included in the area of suggestions for professional growth:

> Technology and Learning: Members of the Ontario College of Teachers may choose to: -increase their competency in computer, telecommunication, videoconferencing, CD-ROM and videodisc technology; join a listserv; integrate technology into teacher practice; enrol in a distance education program. (Ontario College of Teachers Foundation of Professional Practice, 2008, p.25)

The practical implication of these suggestions would require some strategic changes within the university structure and external organization (Fullan, 2001a). The Concerns Based Adoption Model (CBAM) is an approach to implement change within organizations. It was originally proposed in 1973 and has been extensively used as a model of change within schools (Hall & Hord, 1987). Fullan (2001b) speaks of the importance of effective leadership that is necessary for change in educational organizations. Action Research is a type of investigation that can be used professional practitioners to promote positive social change involving systematic research of new actions to improve their effectiveness (Gall, Gall, & Borg, 2005).

## 5.4 Theoretical implications

The theoretical implications examine the link between the laptop and faculty adoption through the diffusion of innovations theory by Rogers (1962). It examines the learning of the laptop skills by faculty and the influence education systems have on this learning. Dewey (1934) believed that the purpose of education was to give the young the 'things' they need to become part of society. The 'things' would include the tools and skills needed to be functional members of society. Darwin (1871) suggests that one of the strengths of humans as a species was the ability to invent tools. Teacher educators instruct preservice teachers the pedagogy for the classroom, and once they have graduated these teachers teach students some of the tools required for survival in our society. ICT innovations have increasingly become tools that are needed to be learned by students in the classroom to become functional in society. The adoption of ICT tools follows the patterns of theory of diffusion of innovations by Rogers (1962).

### 5.4.1 Diffusion of innovations

This Faculty of Education could be considered an early adopter of the laptop when compared to similar educational institutions in Canada as it was the second university to adopt a ubiquitous laptop program. By contrast, laptop universities were initially established in the United States in the early 1980's (Brown & Pettito, 2003). Rogers (2003) suggests that organizations, such as a university, have stages in the innovation process that are different than those for the individual. The adoption process in an organization is divided into five stages, with the first two, 1) agenda setting and 2) matching, considered to be the initiation process involving planning how to integrate the innovation. The implementation process follows and is divided into three stages 3) redefining/restructuring, 4) clarifying, and 5) routinizing where it becomes a part of the regular activities of the university.

In the case of this university, the Dean, was the change agent that made the decision in the organization, suggesting to the faculty that the adoption of a ubiquitous laptop program would increase the marketability of the preservice teachers in being hired post graduation. The decision to adopt occurred in 2000, supported by all faculty members, many of whom, at that time, had limited experience in integrating the laptop into their teaching (Stewart, 2003). Rogers (2003) indicates that when an innovation

originates within the institution, the stages in the innovation process can appear muddled and overlapping. This university as an organization appeared to be in all three stages of the implementation process at once, while the restructuring and clarifying of the innovation developed towards routinzing. Data suggested that individual faculty members were in various stages of the innovation-decision making process in the integration of ICT into their teaching.

The individual innovation-decision making process includes five main stages: 1) knowledge, 2) persuasion, 3) decision, 4) implementation, and 5) confirmation (Rogers, 2003). Although the Faculty of Education as an organization adopted the laptop, each individual professor had to undergo the decision making process in their degree of utilization of the laptop, including each separate computer application, in their classroom. The professors could be categorized by their degree of innovativeness. Rogers (2003) defines the five adopter categories as: 1) innovators, 2) early adopters, 3) early majority, 4) late majority, and 5) laggards. The rate of adoption refers to the speed that the innovation is adopted by the social system and often follows an s-shaped curve. A related overall measure, similar to the adoption rate, was the measure of confidence and skill in using ICT. The faculty members were asked to rank themselves in confidence and skill according to the ACoT categories, entry, adoption, adaption, appropriation and invention (Table 9). Gladhart (2001) used these categories as a model to indicate levels of ICT integration by teachers.

As innovations are diffused, many are re-invented or modified by the user in the process of adoption and implementation (Rogers, 2003). The knowledge of existing tools enables an innovator to use the tool in novel ways that may be useful for other members of society. This could occur at the invention level, for example, where teachers would find new ways of utilizing ICT in the classroom.

In this university, the overall adoption rate of the laptop for use in the classroom was compounded by an additional factor. The Dean spoke of his concern over the professorial turnover rate within the university, where each year professors either left or retired, and new professors were hired. Each newly hired professor, if they had not taught with a laptop prior to teaching at the university, would go through a similar adoption decision process as the previous professors. Also, the entrance ICT proficiency skills and

experience of the newly hired professors would likely have an impact on whether or not ICT would be integrated into their teaching. The issue of new faculty requiring additional support to integrate technology in their teaching was recognized by Bohannon, (2001). Faculty development in ICT integration might have increased the rate of adoption, however, recently hired professors indicated that there was little faculty development provided.

### 5.4.2 Learning about the laptop

Rogers (2003), in describing diffusion of innovations, indicates that each innovation has characteristics that help explain their different rates of adoption. These characteristics, considered by the individual in the decision making process to adopt an innovation, include: 1) relative advantage, the perceived degree which an innovation is better that what was used before, 2) compatibility, the degree to which an innovation is consistent with existing values, past experiences, and needs of the adopters, 3) complexity, the degree to which an innovation is perceived as difficult to understand and use, 4) trialability, the degree to which an innovation can be experimented with, and 5) observability, the degree to which the results of an innovation can be observed by others. A higher adoption rate generally occurs with innovations that have greater relative advantage, compatibility, trialability, observability and less complexity (Rogers, 2003).

The decision making process of a professor choosing which textbook to use in a course can be simplified as a binary decision of using a book or not. If the choice is to use a text, then there is a question of which text is most suitable. The skills needed to use the textbook would include reading level and perhaps any subject specific skills and prior knowledge needed for the student to engage with the material. However, the decision making process in adopting the laptop is additional to those subject matter decisions, and complicated by the sophistication of the laptop itself. Thus, part of the innovation decision making process of each faculty member includes the use of the laptop itself, as well as the adoption of each available software program.

The innovation adoption process is a complex decision making process. The professors require knowledge about the innovation. This would include how a particular tool would be used in a classroom situation. It would then be compared to what was done before to determine the relative advantage. The relative advantage is the expected

benefits compared to the costs of adoption, consideration of economic profitability, low cost, a decrease in comfort, social prestige, a saving of time and effort, and immediacy of reward (Rogers, 2003). The concept of the technology saving time has multiple considerations as often there may be more time spent in unexpected ways. It requires time to learn how to use an application. There is a loss of time when the supporting infrastructure, such as wireless internet or email fails.

The compatibility of the innovation to each adopter varies as each faculty member has their own values, experiences and perceives the needs of the preservice teachers in their own way. Many people tend to teach as they were taught (Lortie, 1975) and therefore are reluctant to change. The fact that many of the faculty who have been teaching at the university for some time and have not had the opportunity to try teaching in schools with ICT may have an impact on their reluctance to use it in the classroom. Some faculty may realize that there is a lack of ICT support within the classroom and revert to more traditional methods that would be more pragmatic for the preservice teacher.

Rogers (2003) describes any method where messages get to one individual to another as ‘communication channels’. At the knowledge stage, the mass media is important where it can be used to reach a large audience quickly, create knowledge, spread information, and change weakly held attitudes. However the interpersonal channels involve a face-to-face exchange between two or more individuals, and are more important at the persuasion stage. Within the survey, it was found that most of the faculty did discuss technology mainly with colleagues and preservice teachers. The communication channels within an organization exist in both mass media and interpersonal. Communication with colleagues was considered one of the greater methods of faculty learning their ICT skills.

This value of the social network is difficult to measure and is considered social capital (Frank, Zhao, & Borman, 2004). These interpersonal channels could influence the decision of an individual to adopt an innovation. More recently the widespread use of the Internet has enabled people to make more informed decisions before adopting an innovation. One can learn the knowledge about an innovation by many means, radio, television, print material, or websites. The more personal experiences of others, who have

used new innovations, are sources of learning through the Internet using such ICT tools as blogs or wikis. McLuhan (1967) has described the world in the electronic age as a global village. Through these multiple communication channels, there is a greater potential for access to information and potential new innovations.

The adoption of the new tool is also dependant on its complexity. There is a paradox in describing the complexity of the laptop because it has functions that are easy enough for a child to learn, such as Logo (Papert, 1993), yet some applications require training and a high degree of computer proficiency. The complexity of the innovation is a key factor within this study. Some of the professors indicated that they wanted to continue to learn more about a certain software program but had little time. Part of the decision making process was valuing the time needed to learn how to become proficient in the use of the tool. Urbain-Lurain (2000) coined the term Fluency with Information Technology (FIT) rather than computer literacy. People who are FIT have coping skills and an understanding of ICT that enables them to make the tools more useful to them. Learning how to effectively use the innovation often requires time—a point noted by both faculty and preservice teachers and a commonly cited barrier in learning how to use the technology (Lim, 1999; Stewart, 2002; Brown & Pettito, 2003; Thompson, Schmidt & Davis, 2003; Wicker & Boyd, 2003; Scott, 2005; Resta, 2008).

Information and communication tools share certain characteristics that increase their utility, in that tool usefulness increases with fluency, and tool fluency increases with use. This fluency of tool use comes with time and practice. Having a laptop with anytime anywhere access, increases the opportunity for greater fluency. Effective faculty development can further provide the professors with an opportunity to learn complex tools as well as ICT integration, and thereby increases the rate of adoption of innovations (Guskey, 2000; Judge & O'Bannon, 2008).

The Matthew Effect (Merton, 1968) was originally coined to describe how increased number of citations used in scientific journals themselves begot more citations. This term was also used in the context of reading (Stanovich, 1986) to denote the positive effect of reading in improving reading skill. When applied to the context of ICT use, the Matthew Effect could be framed as computer fluency or literacy, in that the more fluent

one becomes in using the tool, the greater one's skills and ability to create innovations with those tools becomes.

Trialability is where an innovation can be experimented on before adoption (Rogers, 2003). The trialablity requires that the professors have time to learn how to use the innovation to understand and observe how it would work in improving education. Workshops can be helpful in discovering the potential of some technical innovations providing observability, the availability the innovation is able to be viewed by others (Rogers, 2003). Faculty do not normally have the opportunity to observe another faculty member teaching, so there is little chance for direct observation of colleagues using ICT in a classroom environment. The few workshops that were provided would provide opportunities for observing the innovation but most were not well attended. The computer professor indicated that he was disappointed that other professors did not take the opportunity to visit a school that did have a laptop program working. The adoption rate of an innovation is enhanced when someone can observe the innovation being used (Rogers, 2003). This is the opportunity for the individual to see the perceived advantages.

Information and communication tools share the same diffusion of innovation adoption patterns of other innovations. Ancient information and communication tools such as language, writing and printing would have experienced a similar process of adoption (McLuhan, 1962) and modern ICT demonstrates similar adoption patterns as it is accepted into society. Dawkins (2006) describes that ideas or innovations spread like memes through society. ICT tools evolve and can carry remnants of previous tools like bits of 'useless' DNA, for example the QWERTY keyboard pattern lingers on even though another more efficient pattern exists (Diamond, 1995; Rogers, 2003).

Diamond (1995) in his studies of successful societies suggests that technology tends to develop faster in productive areas with large populations. The greater the number of people who can communicate, the more potential there is for innovators and competition. In ancient times some populations were isolated from others limiting the sharing of ideas and tools. With the electronic age and the Internet of the information age our global village enables communication throughout the world.

The opportunity to use a tool increases with its availability. McLuhan (1962) relates the earlier technological advancement of printing of books to breaking the

monopoly of the library. The printed book increased its availability and therefore increased the opportunity for fluency. The portability of the book gave rise to individualism. A similar analogy could be made for the laptop breaking the monopoly of the desktop computer in a computer lab. The laptop, with its portability, makes it more available to use in more locations, at more convenient times (Brown, 2000; Brown & Pettito, 2003; Weeks & Kariuki, 2003). The more opportunity for use of the laptop may increase its use and therefore increase ICT fluency in a group, similar to a positive feedback loop.

### 5.4.3 Education systems

One of the factors in the eventual adoption of an innovation is its 'complexity' (Rogers, 1995). Education systems, through teachers, have the potential to teach students the skills of reading and writing, the basic tools necessary for understanding the complex tools of ICT (Urbain-Lurain, 2000). It is this systemic learning at a country wide level that enables the individual student to learn the complex tools of reading and writing. At some point in time, many students do eventually become teachers, and it would be to their advantage to have ICT fluency as early as possible.

Teacher educators have an exponential potential to increase the fluency of ICT through the education of preservice teachers who will teach in schools. Teachers usually teach as they were taught in teacher preparation programs (Lortie, 1975). Faculty of Education professors teach preservice teachers methodologies based on their own previous learning and experience. When education faculty model effective teaching strategies, including the integration of ICT into teaching, this has an influence on how future teachers will teach in the schools (Ellis, 2004; Lortie, 1975). Faculties of Education have a tremendous exponential effect on the impact of education in society including the teaching and learning of ICT. However, technology is changing fast enough that some teacher educators have not had the opportunity to learn how to integrate ICT into their teaching (Wicker & Boyd, 2003).

External societal systems such as school boards and government have an influence on the success of ICT integration in schools and teacher education through the control of resources, rules, curriculum and division of labour. Part of the success of the

rise of the United States as an economic power in the 20th century has been attributed to its public educational policy (Goldin, 2001).

The government is an external system that sets the rules or policies for education. Within Canada, education is controlled at the provincial level. A few countries in the world have adopted a set of ICT standards, developed by ISTE and recommended by UNESCO (2002). These ISTE NETS (2004) extend to students, teachers, administrators and teacher educators assisting in achieving the common goal of each the interrelated systems by fostering the support of ICT in education. The ICT standards do not stand alone and are supported by the Essential Conditions (ISTE, 2004).

The International Reading Association (IRA, 2002) recognizes the link between language and ICT in a position statement on integrating literacy and technology in the curriculum, "To become fully literate in today's world, students must become proficient in the new literacies of ICT. Therefore, literacy educators have a responsibility to effectively integrate these technologies into the literacy curriculum in order to prepare students for the literacy future they deserve." (International Reading Association, 2002, p. 2).

A lack of ICT standards in education creates an inequitable learning experience for students where some children have an opportunity to learn ICT, the tools needed to survive in society and other children do not. The IRA states the importance of ICT integration for an equitable education for all students, how staff development is needed to prepare teachers to integrate ICT, and the importance of teacher educators have in preparing new teachers to use ICT (International Reading Association, 2002).

The Ontario government is supportive of ICT, but encouragement rather than standards permits an inequitable learning environment for students. The Language curriculum document for elementary schools (Ontario Ministry of Education, 2006), the English document in secondary (grade 9 and 10) (Ontario Ministry of Education, 2007), and the English document in secondary (grade11and 12) (Ontario Ministry of Education, 2007) have a paragraph on the importance of ICT with the same supportive statement: "Whenever appropriate, therefore, students should be encouraged to use ICT to support and communicate their learning." (p. 30, p. 35). This statement enables teachers and teacher educators to continue to maintain a status quo. One teacher could teach with ICT

and another without and both would be following the curriculum. Teacher educators in Ontario need only to encourage preservice teachers to utilize ICT in their teaching rather than uphold any ICT standards required by their American colleagues.

The encouragement of ICT is continued throughout the Ontario curriculum. The Ontario government includes the acquisition of basic ICT skills such as keyboarding and word processing a part of the optional Information and Communication Technology in Business course, part of the Business Studies curriculum taught at the grade 9 or 10 level (Ontario Ministry of Education, 2006) or the Integrated Technology course part of the Technological Education curriculum (Ontario Ministry of Education, 1999). The Ontario Language curriculum encourages polished writing with a word processor yet it has no standard that establishes the basic skill of keyboarding, or touch typing. In contrast, the ISTE NETS for students introduces ICT skills such as keyboarding at a primary level (ISTE NETS, 2004). These differences create an inequity between countries that choose to adopt the standards and those that do not. The focus of the thesis is not to create a critique of the Ontario curriculum, however, if ICT skills are not included in the curriculum there is no motive for the teacher educators to teach about these skills to preservice teachers.

UNESCO (2008) has created ICT-CST Competency Standards Modules where a policy recognizes the needed changes in education. “Traditional educational practices no longer provide prospective teachers with all the necessary skills for teaching students to survive economically in today’s workplace.” (UNESCO, 2008, p. 3). The support for ICT integration in schools is clearly stated, “Schools and classrooms, both real and virtual, must have teachers who are equipped with technology resources and skills and who can effectively teach the necessary subject matter content while incorporating technology concepts and skills” (UNESCO, 2008, p. 3). The recognition of the importance of ICT standards in education is present at the international level and many developed countries, yet Ontario chooses to encourage rather than set standards in ICT.

The state of Maine is one example of a government that has provided laptops for all children at the grade seven and eight level (Papert, 2001). By adopting the ISTE NETS and providing laptops for teachers and children, it ensures a more equitable level of ICT knowledge, skills and tools for learners to be successful in society. Much of the

reason for technology infusion in teacher education the United States includes; the ISTE NETS and their adoption by NCATE, the NCATE Task Force on Technology in Teacher Education recommending that schools have a technology infusion plan, the availability of U.S. federal funds, and the demand of the K-12 schools for technology trained teachers (Beyerbach, Walsh, & Vannata, 2001).

The inequity exists within the university as the wide variation of ICT skills by faculty provides an inequitable learning environment for the preservice teacher. As well, the preservice teachers had a mixed field experience where some practice taught in a rich ICT supported school environment while others experienced little opportunity for ICT integration. Establishing ICT standards at the university for teacher educators (UNESCO, 2002), would help to provide a more equitable learning for each preservice teacher.

The recommendation of the university adopting ICT standards was suggested previously by Weeks and Kariuki, (2003). The author is suggesting province wide acceptance of ICT standards and the implementation of the Essential Conditions (ISTE NETS, 2004).

Bin-Taleb (2005) recognized the reluctance of the acceptance of the laptop in higher education in his statement he stated that: “Teaching and learning with laptop computers will never be completely accepted in the higher education community until considerable evidence of the efficacy of laptop computers in this setting is provided.” (Bin-Taleb, 2005, p. 184). The adoption of the laptop in higher education or other educational institutions is dependent on more than just proving the efficacy of the laptop. Rogers (1995) identifies the process of adoption of innovations and stated: “Technological innovations are not always diffused and adopted rapidly, even when the innovation has obvious and proven advantages.” (Rogers, 1995, p. 10).

### 5.4.4 Faculty development

Professional or faculty development is a major body of literature or research and will be briefly described here in recognition of its potential benefits to education. Traditionally, many teachers and administrators experiences with professional development has been 3 to 4 days of special events throughout the school year. Their concept of professional development has often consisted of a series of scattered short term workshops and presentations with little follow up for implementation (Guskey,

2000). In a Faculty of Education consisting of former teachers, it would not be surprising for faculty members and administration to carry this same view.

Guskey (2000) states that the defining characteristics of professional development are an 'intentional, ongoing, systemic' process. The intentional aspect of professional development includes a clear statement of worthwhile goals that can be assessed. The ongoing process includes the recognition of lifelong learning throughout a professional career. The systemic aspect considers that both the individual and organizational development is necessary for improvement. The short sporadic workshops are ineffective (Guskey 2000). Traditionally, teachers have had workshops where they would evaluate the workshop presenter, however it is more logical that the evaluation should be given to the teachers to see if learning has occurred. Professional development should be evaluated to determine if it is effective (Guskey, 2000).

There are seven major models of professional development each with their advantages and disadvantages including: training, observation/assessment, involvement of a development/improvement process, study groups, inquiry/action research, individually guided activities and mentoring (Guskey, 2000). Each of these could be explored in developing a model of faculty development for the university. A varied approach would give faculty a choice in their preferred learning style. An ICT course for faculty, as suggested in the data collection, would provide a certain standard with an evaluation. This course would be completed by all newly hired professors entering the Faculty of Education and could be taught by experienced faculty who have taken the course. This would also provide the opportunity for mentoring.

Of the models examined in the literature review at Faculties of Education, Judge and O'Bannon (2008) described a promising initiative called Implementing Partnerships Across the Curriculum with Technology Project (Project ImPACT) which was founded on the ten essential conditions (ISTE, 2002). The model was funded by the Preparing Tomorrow's Teachers to Use Technology. There was emphasis on access, training, support, incentives and evaluation. It used a variety of approaches to faculty development, which was supported by the institution and included evaluation to determine effectiveness. The purpose for the project was to address the ISTE NETS (2004) which were adopted by NCATE to reform teacher education.

The UNESCO (2002) document, *Information and communication technologies in teacher education: A planning guide*, describes in detail effective procedures to implement ICT within educational institutions in any country. This document describes background research, the importance of effective faculty development, ICT standards and the Essential Conditions necessary for successful ICT integration.

In summation of the theoretical implications, the information and communication tools follow adoption patterns identified by Rogers (1962) in his theory of diffusion of innovations. The adoption decision making process to use the laptop was established by the Faculty of Education, however the individual professor undergoes an adoption decision making process to utilize ICT within the classroom. Increased fluency in using ICT can occur with increased use and practice (Merton, 1968, Urbain-Lurain, 2000). Education systems can enhance learning of complex tools such as ICT which is further supported when ICT standards are established for students, teachers, administrators and teacher educators (UNESCO, 2002). Effective faculty development includes a intentional, ongoing, systemic process supported with evaluation (Guskey, 2000). Inequitable learning environments can exist in all educational institutions because of a lack of ICT standards in Ontario, which needs to be established and supported at the government level.

## 5.5 Limitations

The faculty survey had a 73% response rate with 39 out of the 54 contacted faculty members replying to the survey and 36 completing it fully. There were 15 faculty members who did not respond including faculty who left the university prior to the start of the survey. If a faculty member did have an aversion to use of technology, an online survey could have been a reason for not participating. Overall, 73% is a good response rate exceeding the 50% response rate considered by Dillman (2004) as acceptable for online surveys. The interviewed faculty members were chosen through purposeful sampling to include at least a participant from each of the three teaching divisions, primary-junior, junior-intermediate and intermediate-senior and different subject areas. The faculty interviews included both male and female, inexperienced as well as more experienced, and were chosen to get a representation of time spent teaching at the

university. It would have been worthwhile to get interviews from a part time faculty to understand their perspective.

Evidently, through the comments of the preservice teachers, there existed a few faculty members who did not actively use the laptop in their teaching. All faculty who completed the survey as well as the seven faculty members who were interviewed stated that they did use the laptop to some degree in their teaching. It would have been interesting to interview the faculty who did not integrate the ICT into their teaching to uncover their views on the laptop program. However, it would have been unethical to specifically seek out a faculty member after interviews with previous preservice teachers.

Bias is a concern in research studies (Cohen, et al., 2000). The bias that has potential to exist is that I am employed at the university and conducting the study. Recommendations that were not derived from interviews and surveys but were a product of my personal data analysis and conclusions are stated as such.

Bias may occur within the selection process of subjects (Cohen, et al., 2000). To address the potential of research bias in this study, purposeful sampling was involved within the selection process of faculty members interviewed. One faculty member who taught computers was specifically asked to include a professor who would be likely to actively integrate ICT into his teaching. I was not aware of any professors who specifically chose to not integrate ICT into their teaching at the time of data collection so none were interviewed.

Bias can exist in the interview interaction. There is a tendency for interviewers to seek out answers that support preconceived notions (Gall, Gall & Borg, 2005). Questions were derived from Paul (2004) who interviewed writing instructors at a university. An initial pilot interview using Paul's instrument determined that it was too long and questions were removed to shorten the process. Additional questions were added to fit the context of this study.

Bias can exist in diffusion of innovation research where the innovation is considered to be an improvement in a study, but this can be a value judgment by the researcher (Rogers, 2003).

## 5.6 Further Research

There are vast areas of research needed with the use of the potential of ICT tools and the efficacy of laptop programs in learning ICT fluency. This would include use in schools, both elementary and secondary, as well as higher education including teacher education. Further research about the perspectives of the change agents, such as administrators and politicians, about their attitude towards the integration of technology into education are important if change is to occur.

Presently there are a number of schools, school boards and states such as Maine (Papert, 2001) that soon will have graduates of ubiquitous laptop settings entering the work force. There are also colleges and universities that are requesting that all students purchase laptops. This creates an environment where, because of financial resources or geographic location, there is an inequitable educational experience. This is creating a digital and educational divide between the rich and poor where some students will have the advantage of having ICT skills to be successful in society. Finn and Inman (2004) surveyed alumni to study the effects of ubiquitous computing to see if a digital divide existed. Similar, longitudinal studies tracking of B.Ed. graduates in reference to further education and employability compared to graduates of a non-laptop setting would help us better understand the efficacy of the laptop in the classroom. What advantages do people have when trained in a rich ICT environment compared to others that do not have that experience?

Some studies such as Cuban, (2001) indicate that some teachers had difficulty in accepting ICT because of the frustration of technology breakdowns. The UNESCO (2002) document suggests technological support as part of the Essential Conditions that foster successful ICT integration. A study where teachers were taught some problem solving skills and technical expertise in dealing with technology and compare the success rate with teachers who are not taught these skills may be worthwhile. Perhaps successful teaching of technology requires some background in repair and maintenance of technological tools.

The computer and the required infrastructure required to support ICT is expensive. Much of the literature did not include costs for implementation. Further research could be of a practical nature in estimating how much it would cost to provide

every teacher and as well as students of a certain age in Ontario with their own laptop with the supportive infrastructure. These costs could be compared to an estimated opportunity cost of not providing children with ICT skills.

There may be a critical period in child development when language acquisition is optimal and as we age, fluency becomes more difficult to attain (Vygotsky, 1962; Ingram, 1993). If one considers modern ICT as an extension of language, perhaps older people who are not accustomed with ICT have more difficulty in developing fluency with computers. This consideration is important as most Faculty of Education professors are of experienced years. If this sensitive period exists in development, the learning of ICT skills at an early age to obtain fluency increases in importance. The Ontario curriculum could be reviewed to reflect the optimal period of learning ICT skills. Research on the ideal age for acquiring ICT fluency could be worthwhile.

Rogers (2006) studies on the effectiveness of keyboarding and its links to learning and computer proficiency could be extended into research in Faculties of Education. The measurement of keyboarding skills of preservice teachers prior to entering the B.Ed. program could be compared to overall computer proficiency. Presently, the teaching of keyboarding is ignored or assumed by faculty yet there is a wide variation in skills as the preservice teacher, Patty, mentioned in her interview. She felt this lack of keyboarding skills put her at a disadvantage compared to other preservice teachers.

It would be interesting research to pursue the connection with typing speed and computer proficiency. Rogers (2006) work on the link between typing speed and computer proficiency is important. This research could pursue the attitude towards typing and relate this to a class or gender issue. Typing historically and stereotypically has been linked to girls who would be secretaries working for a male who could not type. One of the preservice teachers indicated in her interview that she did not take typing in high school as this was for girls who would stay in secretarial work. On the advice of her parents she elected not to take typing as she expected to have a secretary to do that kind of work for her someday. If the link between typing and the stereotypical female secretary still exists, it may have a societal influence in the behavior of both males and females. If there is a lack of typing skills and therefore computer proficiency in males

graduating from high school, this could uncover the link between the current trend of the decline in enrolment of males attending and graduating in universities.

Online education requires a certain level of computer proficiency. A worthwhile study could determine if there is a link between keyboarding and success in taking online courses.

The condescending attitude towards the computer as a 'glorified typewriter' has been noted in society and in the literature (Palmquist et al., 1998). Attitude towards the adoption of technology is difficult to measure or quantify as attitude's can change with time. Perhaps critics who carry this negative attitude toward technology have not experienced immersion within a laptop program to gain ICT fluency. Kay and Knaack (2005), in their study of computer attitudes, ability and use of preservice teachers in an Ontario ubiquitous laptop teacher preparation program, found significant positive differences in behavioural attitudes and self efficacy over the course of the year long program. By considering the impact attitude has on adoption of technology, additional research could be done in this area with administrators of educational institutions who make decisions on how resources are allocated.

There are a number of teachers graduating from Faculties of Education who have not had the opportunity to participate in a laptop program. A study on the use of ICT integration in schools by teachers who have graduated from a laptop program compared to those who have not would be worthwhile to determine the frequency and quality of integrating ICT into their teaching.

Some of the studies examined had teachers teaching with computers at the same time they are learning how to use it (Gardner, Morrison, Jarman, Reilly, & McNally, 1993). A repetition of these studies where teachers have gained a level of fluency in using the computer prior to teaching the students may yield different results.

Ellis (2004) used action research in his study of encouraging faculty to integrate more ICT within their teaching. The advantage of action research is that there is an effort to accomplish the integration. The difficulty with a study such as a survey or an interview process is that although it increases awareness of ICT integration, it does nothing to encourage ICT integration. Many changes can only be accomplished at the administrative

level. Using action research, we can study the process of implementation and can influence the outcome.

The UNESCO (2002) document describes the importance of faculty development. A study could be conducted on what kind of faculty development has been most successful and measured in terms of academic output and increased teaching as well as cost. Future research could include studying varying models of faculty development at different institutions. Faculty development through incentives has proven to be effective in some universities (Brown, 2000). By recognizing the learning of ICT as part of the tenure process (Scott, 2005), we may encourage new professors to incorporate ICT into their teaching and research.

Ubiquitous computing has changed education in that it is very tempting for students to be off task (BinTaleb, 2005; Scott, 2005). This tendency for off task behavior is prevalent at all education levels in ubiquitous computing. Effective classroom management strategies that are effective in controlling off task behavior could be studied and taught to teachers teaching in a ubiquitous laptop environment.

Further research could include studies of other teacher education programs that have a laptop program. Examining how education faculty perceived they were learning ICT at these institutions may benefit those who are teaching in a ubiquitous laptop environment. Studies would consider the context of the institution including all factors that have an influence on the outcome. A comparison how faculty are learning ICT at similar educational institutions from different countries with and without the ISTE standards would be worthwhile.

This study indicates that interaction with colleagues was an important method of learning about ICT. Some faculty may have developed a community of practice (Wenger, 2008). Further research into the collegial environment of Faculties of Education as a learning environment would be worthwhile.

## 5.7 Summary

Chapter Five included a summary and discussion of the answers to the research questions and suggested some possible recommendations. The practical implications compare the findings of this study to previous studies. The theoretical discussion included how the laptop and ICT tools follow Rogers (1962) diffusion of innovations,

how school system encourage the learning of complex ICT tools and how effective faculty development requires a intentional, ongoing, systemic process. The limitations for this study were described. The opportunities for future research are vast in this growing field of education.

In summary, as little as thirty years ago and prior to the advent of the personal computer, teaching computing in schools required the use of punched cards. The business curriculum required that those choosing a secretarial career learn the skills of typing. Although the Ontario Ministry of Education recognizes and encourages the use of ICT throughout its curriculum, the skills to develop ICT fluency are still housed within these older frameworks. Incorporating and resourcing ICT would have the largest impact on enhancing ICT integration by faculty in the B.Ed. program. Many countries, as well as UNESCO (2002), have set ICT standards for education but to ensure their success, they should be supported with the Essential Conditions (ISTE, 2004).

Within a school setting, developing computer proficiency skills can be done with a single computer in a classroom or within a computer lab. However, there is substantial research supporting the laptop as an effective method of increasing ICT proficiency skills, giving people the individual freedom to learn anywhere and anytime. This opportunity for increased use provides a greater prospect for ICT fluency. The availability of the computer or laptop alone does not guarantee the increase in ICT skills. Information and communication tools, such as language, writing and ICT are complex enough that learning can be enhanced through effective teaching.

At the present time, the transition stage exists where the rate of technology development has increased at such a pace that teachers may not have had the opportunity to learn the ICT skills when they were students in a classroom. This transition extends to the teacher educators who have to learn ICT, how to teach with technology and effectively model integration within their own teaching for the preservice teacher.

There is a general expectation that teachers be knowledgeable in their subject area as well as teacher educators. Obtaining the knowledge and skills in teaching and integrating ICT is a professional responsibility taken on by education professors. This study found that learning ICT skills and integration methodology by faculty at the university is occurring mainly through self teaching, working with colleagues and the

help of technology assistants. The professors through their own suggestions indicate that ICT learning can be increased with effective faculty development.

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## Appendices

### Appendix A: Faculty Online Survey

**(http://www.surveyconsole.com/console/TakeSurvey?id=297004&)**

(Survey starts with online consent form, see Appendix H)

Please click your response on the following questions.

1. Gender:

    1. Female
    2. Male

2. In which age group are you?

    1. 26 - 30
    2. 31 - 35
    3. 36 - 40
    4. 41 - 45
    5. 46 - 50
    6. 51 - 55
    7. 55 - 60
    8. 61 - 65
    9. 65+

3. How many years have you taught in a classroom in the regular school system? (not administration)

    0, years, 1-5 years, 6-10 years, 11-15 years, 16-20 years, 20+ years.

4. How many years have you held a non-teaching position in education? This would include administration or consulting.

    0 years, 1-5 years, 6-10 years, 11-15 years, 16-20 years, 20+ years.

5. How many years have you taught at the university?
1 year, 2 years, 3 years, 4 years, 5 years, 6 years, 7 years, 8 years, 9 years, 10 years, more than 10 years.

6. How many years have you taught at the post secondary level, other than the university?
0 years, 1-5 years, 6-10 years, 11-15 years, 16-20 years, 20+ years.

7. What degrees have you attained?

1. Undergraduate degree
2. Bachelor of Education
3. Masters
4. EdD
5. PhD
6. Other

8. What rank do you currently hold?

1. Lecturer
2. Assistant Professor
3. Associate Professor
4. Full Professor
5. Other

9. Prior to teaching at the university, how would you rank your information and communication technology skills?

1. Very weak
2. Weak
3. Good
4. Strong
5. Very strong

10. To the best of your knowledge, select the information and communication technology you were comfortable with prior to teaching at the university. (Likert: Very Weak, Weak, Good, Strong, Very Strong)

1. Keyboarding
2. Email
3. Word Processing (i.e., MSWord, WordPerfect)
4. Spreadsheets (i.e., Excel)
5. Presentation Software (i.e., Powerpoint)
6. Desktop Publishing (i.e., MS Publisher)
7. Graphics Software (i.e., CorelDraw, Adobe PhotoShop)
8. Website development
9. Internet to retrieve information
10. Internet to retrieve research articles

11. Storage of data on a CD
12. Smartboard
13. WebCT course development (or similar program)
14. Synchronous chat (i.e., MSN, Yahoo)
15. Online course development
16. Multi-media presentations
17. Course related software programs
18. GPS
19. Other

11. How would you rank your information and communication technology skills at this time? (Likert: Very Weak, Weak, Good, Strong, Very Strong)

1. Keyboarding
2. Email
3. Word Processing (i.e., MSWord, WordPerfect)
4. Spreadsheets (i.e., Excel)
5. Presentation Software (i.e., Powerpoint)
6. Desktop Publishing (i.e., MS Publisher)
7. Graphics Software (i.e., CorelDraw, Adobe PhotoShop)
8. Website development
9. Internet to retrieve information
10. Internet to retrieve research articles
11. Storage of data on a CD
12. Smartboard
13. WebCT course development (or similar program)
14. Synchronous chat (i.e., MSN, Yahoo)
15. Online course development
16. Multi-media presentations
17. Course related software programs
18. GPS
19. Other

12. Check in the boxes below which best describes how you have learned your skills in information and communication technology? (Choice: Never, Rarely, Sometimes, Often, Very Often)

Self Taught, Computer Courses, School Board Professional Development Workshops (other than the university), Faculty Development Workshops, Colleagues, Student Technical Assistants (STAs), University Technical Assistants, Students (not STAs),

Associate Teachers, Conferences, Other.

13. List any additional information and communication technology skills you would like to learn.

14. Select the information and communication technology that you have integrated into your teaching at the university. (Choice: Never, Rarely, Sometimes, Often, Very Often)

1. Keyboarding
2. Email
3. Word Processing (i.e., MSWord, WordPerfect)
4. Spreadsheets (i.e., Excel)
5. Presentation Software (i.e., Powerpoint)
6. Desktop Publishing (i.e., MS Publisher)
7. Graphics Software (i.e., CorelDraw, Adobe PhotoShop)
8. Website development
9. Internet to retrieve information
10. Internet to retrieve research articles
11. Storage of data on a CD
12. Smartboard
13. WebCT course delivery (or similar program)
14. Synchronous chat (i.e., MSN, Yahoo)
15. Online course development
16. Multi-media presentations
17. Course related software programs
18. Other

15. Describe the successes you have experienced in integrating information and communication technology into your teaching?

16. Describe the challenges you have experienced in integrating information and communication technology into your teaching?

17. Do you discuss effective integration of information and communication strategies with:

(Choice: Never, Rarely, Sometimes, Often, Very Often)

1. Colleagues
2. Students
3. Technology experts

4. Teachers in the field
5. Administration
6. Colleagues outside the Faculty of Education
7. Family or friends

18. How many of your assignments would require the students to integrate information and communication technology?

1. None
2. Few
3. Some
4. Most
5. All

19. Briefly describe your course assignment(s) that integrate information and communication technology.

20. List the information and communication technology you use in the preparation of your lessons.

21. List the information and communication technology you use for delivery and implementation of your lessons.

22. Describe examples of the information and communication technology students use in your classroom. Please also list any OSAPAC software used.

23. List the information and communication technology you have used to accommodate students with special needs in the Faculty of Education (if required).

25. What information and communication technology tools or strategies are you familiar with, if any, that you have chosen not to use?

26. Do you use information and communication technology for assessment? If you answered yes, list the technology is used.

1. Yes
2. No

3. Technology used

_____
_____

27. Do you use online delivery for any part of your courses? If yes, briefly describe how you use online technology in your course.

1. Yes
2. No
3. Describe how technology is used

_____
_____

28. Select any additional technology hardware that you use in your teaching .

1. Printer
2. Data projector
3. Digital camera
4. Scanner
5. Smart board
6. Palm pilot
7. MP3 player
8. USB key
9. Scientific measurement devices
10. AlphaSmarts
11. Assistive technology
12. Video
13. Other _____

29. Are you familiar with any educational standards that mandate the use of information and communication technology at the following levels. If yes, click in the box beside the organization.

1. The University
2. School Board
3. Ontario Ministry of Education
4. Ontario College of Teachers
5. Canada
6. International
7. Not familiar with any

30. To what extent do you feel the administration at the university supports the integration of information and communication technology into teaching?

1. No support
2. Minimal support
3. Some support
4. Adequate support
5. Very supportive

31. How would you rate faculty development initiatives in information and communication technology at the university?

1. Needs Improvement
2. Weak
3. Fair
4. Good
5. Excellent

32. As Faculty increase their confidence and skill in using technology, they move through a series of stages similar to what the Apple Classrooms of Tomorrow (ACoT) identify as levels of teacher expertise. Please select the stage below that you feel bests characterizes where you are currently in your level of use of technology in your instruction.

1.Entry Stage: Educators struggle to learn the basics of using technology

2. Adoption Stage: Educators move from the initial struggles to successful use in technology on a basic level

3. Adaption Stage: Educators move from the basic use of technology to discovery of its potential for increased productivity.

4. Appropriation Stage: Having achieved mastery over technology, educators use it effortlessly as a tool to accomplish a variety of instructional and management goals.

5. Invention Stage: Educators are prepared to develop entirely new learning environments that utilize technology as a flexible teaching and learning tool. They begin to think with the technology, designing new ways to solve learning problems that their students may have faced in the past.

33. What suggestions do you have to improve faculty development with regard to information and communication technology at the university?

34. If you have any additional comments or suggestions that would be helpful and pertain to this survey, list them in the box below. Thank you again for participating in the survey.

**Appendix B: Faculty of Education Professors Interview Questions**

1. How old are you? How long have you been teaching at the university? What courses have you taught?
2. Would you be willing to provide a brief history of your personal experiences and professional development as a university professor?
3. What skills and perceptions do you hope students take away from your B.Ed. classes?
4. What do you hope your classes do to help your students grow as teachers and individuals?
5. What instructional resources (time, money, assistance) are made available to you?
6. With whom do you interact (students, professors, administrators) to accomplish your teaching goals?
7. When you struggle with your teaching or assessment, where do you find help?
8. What instructional development activities have you participated in, related to both teaching and research? (Please include any self-directed learning).
9. What are some of the challenges and issues you commonly face in teaching? In integrating instructional technology into your teaching? How have they been overcome?
10. How often do you discuss teaching instructional strategies with departmental colleagues?

    With others, including students, technology experts, instructional development practitioners, and colleagues outside the Faculty of Education?

    Think of specific tools (e.g. class exercises, assignments, assessment techniques) that you integrate into your course to facilitate the teaching of instructional technology.

    Can you recall where you first learned about any of the tools you use?

11. How did you develop and implement these ideas into your course?
12. What tools or strategies, if any, have you deliberately decided not to use?
13. What successes have you had in integrating instructional technology into your teaching?
14. What challenges have you had in integrating instructional technology into your teaching?
15. Are the B.Ed. students integrating technology into their teaching?
16. . Are the schools and boards receptive to using technology in the classroom?
17. .What types of technology integration is being used?(Software and hardware)
18. Where do you get most of your information on how to use technology within the classrooms?

19. Have you had any contact with past graduates to find out what types of technology they are now using in the schools and who or what had the most effect on them using technology in the classroom?
20. What types of faculty development in instructional technology have the faculty found most rewarding?

21. The following ISTE NETS for teachers will be distributed. How does the B.Ed. program at the university address these standards in their teacher preparation?

**Appendix C: Faculty of Education Technical Assistant Interview Questions**

1. How old are you? How long have you been working at the university? What have you taught?
2. Would you be willing to provide a brief history of your personal experiences and professional development as a technical assistant?
3. What skills and perceptions do you hope students take away from your B.Ed. classes?
4. What instructional resources (time, money, assistance) are made available to you?
5. With whom do you interact (students, professors, administrators) to accomplish your teaching goals? How often?
6. When you struggle with your teaching or assessment, where do you find help?
7. What instructional development activities have you participated in, related to both teaching and research? (Please include any self-directed learning).
8. What are some of the challenges and issues you commonly face in your position? In integrating instructional technology into your teaching? How have they been overcome?
9. How often do you discuss teaching instructional strategies with departmental colleagues?With others, including students, technology experts, instructional development practitioners, and colleagues outside the Faculty of Education?
10. Think of specific tools (e.g. class exercises, assignments, assessment techniques) that you integrate into your course to facilitate the teaching of instructional technology.
11. Can you recall where you first learned about any of the tools you use?
12. How did you develop and implement these ideas into your course?
13. What tools or strategies, if any, have you deliberately decided not to use?
14. What successes have you had in integrating instructional technology into your work?
15. What challenges have you had in integrating instructional technology into your work?
16. Are the B.Ed. students integrating technology into their teaching?
17. Are the schools and boards receptive to using technology in the classroom?
18. What types of technology integration is being used?(Software and hardware)
19. Where do you get most of your information on how to use technology within the classrooms?
20. Have you had any contact with past graduates to find out what types of technology they are now using in the schools and who or what had the most effect on them using technology in the classroom?
21. What types of faculty development in instructional technology have the faculty found most rewarding?
22. The following ISTE NETS will be distributed. How does the B.Ed. program at the university address these standards in their teacher preparation?

**Appendix D: Faculty of Education Administrator Interview Questions**

1. How old are you? How long have you been working at the university? What have you taught?
2. Would you be willing to provide a brief history of your personal experiences and professional development as a Dean?
3. What skills and perceptions do you hope students take away from your B.Ed. classes?
4. What instructional resources (time, money, assistance) are made available to you?
5. With whom do you interact (students, professors, administrators) to accomplish your teaching goals? How often?
6. When you struggle with your teaching or assessment, where do you find help?
7. What instructional development activities have you participated in, related to both teaching and research? (Please include any self-directed learning).
8. What are some of the challenges and issues you commonly face in your position? In integrating instructional technology into your teaching? How have they been overcome?
9. How often do you discuss teaching instructional strategies with departmental colleagues? With others, including students, technology experts, instructional development practitioners, and colleagues outside the Faculty of Education?
10. Think of specific tools (e.g. class exercises, assignments, assessment techniques) that you integrate into your course to facilitate the teaching of instructional technology.
11. Can you recall where you first learned about any of the tools you use?
12. How did you develop and implement these ideas into your course?
13. What tools or strategies, if any, have you deliberately decided not to use?
14. What successes have you had in integrating instructional technology into your work?
15. What challenges have you had in integrating instructional technology into your work?
16. Are the B.Ed. students integrating technology into their teaching?
17. Are the schools and boards receptive to using technology in the classroom?
18. What types of technology integration is being used?(Software and hardware)
19. Where do you get most of your information on how to use technology within the classrooms?
20. Have you had any contact with past graduates to find out what types of technology they are now using in the schools and who or what had the most effect on them using technology in the classroom?
21. What types of faculty development in instructional technology have the faculty found most rewarding?
22. The following ISTE NETS will be distributed. How does the B.Ed. program at the university address these standards in their teacher preparation?

## Appendix E: Recent B.Ed. Graduate Focus Group Interview Questions

The questions below have been derived and modified from Paul (2004, p.111) who used a similar assessment instrument to interview Writing Fellow who were taught writing at the university.

I. Background (10 min)

1. Introduce myself and ask each student to introduce themselves, describing where they are from and what division they are in.
2. Would you be willing to provide a brief history of your personal experiences and professional development as a B.Ed. student at the university?
3. What skills and perceptions do you hope you will take away from the B.Ed. classes?

II. Teaching Environment (15 min)

1. What expectations, if any, do you perceive the Faculty of Education and the university hold for you as a pre-service teacher?

2. Do you feel you have a "voice" when discussing teaching as a student here at the university? Do faculty or administration listen?

3. What rewards, personally, with colleagues, or students, do you enjoy when you are teaching? What criteria do you use to assess your teaching effectiveness?

4. How many faculty do you interact with in a day? Describe the types of interactions?

5. What instructional resources (time, money, assistance) are made available to you? With whom do you interact (students, professors, administrators) to accomplish your goals? When you struggle with a problem, where do you find help?

6. How would you describe your relationship with your Faculty of Education colleagues?

7. How would you describe the Faculty of Education's support of teaching activities? The university's support?

8. What instructional guidelines and curricular requirements for teaching B.Ed. courses do you follow?

III. Instructional Development (10 min)

1. What instructional development activities have you participated in, related to both teaching and research? (Please include any self-directed learning).

2. Can you identify some of your personal desired outcomes (goals) for instructional training and development? What skills and ideas do you hope to take away from instructional development activities in which you participate?

IV. Classroom Challenges (10 min)

1. What are some of the challenges and issues you commonly face as a B.Ed. student? What challenges do you feel that the faculty has in integrating instructional technology into their teaching? How have they been overcome?
2. How often do you discuss teaching instructional strategies with fellow classmates? With others, including students, technology experts, instructional development practitioners, and colleagues outside the Faculty of Education?

V. Classroom Practices (15 min)

1. Can you describe your idea of an effective Education course within the Faculty of Education? What factors influence you in formulating those ideas?

2. What do you do to prepare for your practice teaching courses and for teaching in general? What influences your decisions when preparing to teach?

3. Think of specific tools (e.g. class exercises, assignments, assessment techniques) that are integrated by faculty to facilitate the teaching of instructional technology.

4. Can you recall where you first learned about any of the tools you use?

5. Have you had the opportunity to develop and implement these ideas into your own teaching?

6. What tools or strategies, if any, have you deliberately decided not to use?

7. What successes have you had in integrating instructional technology into teaching?

8. What challenges have you had in integrating instructional technology into teaching?

9. Do you feel the faculty are integrating technology into their teaching?

10. . Do you feel the schools and boards receptive to using technology in the classroom?

11. .What types of technology integration is being used?(Software and hardware)

12. Where do you get most of your information on how to use technology within the classrooms?

13. Have you had any contact with past the university graduates to find out what types of technology they are now using in the schools and who or what had the most effect on them using technology in the classroom?

14. What types of instructional technology have you found most rewarding?

15. The following ISTE NETS will be distributed. How does the B.Ed. program at the university address these standards in their teacher preparation?

**Appendix G: Faculty Email Invitation to Participate in an Online Survey and Consent**

Aug. 18, 2007

**Dear Faculty Member of the University,**

I am a PhD candidate at the Ontario Institute for Studies in Education, University of Toronto. This survey is part of the doctoral and research work that I am conducting. You are invited to participate in an online survey about the integration of information and computer technology (ICT) within teaching in the Bachelor of Education program. As a Faculty of Education professor you will be asked to complete an online survey that takes approximately 20-30 minutes to complete.

It is hoped that through this study may lead to more understanding of the process of the integration of information and communication technology into the Bachelor of Education and possible improvements to faculty development initiatives.

All of the participants of the survey will remain anonymous. Your participation and contribution is appreciated.

**Information**

- Only Gerald Laronde will have access to the survey data. You will remain anonymous with no way of identification. Real names will be removed or changed to codes in all data collected.
- Participant identity will remain completely anonymous and confidential, including in all reporting of results in scholarly publications and public presentations.
- Individuals may refuse to participate or may withdraw, at any time, without penalty or loss of benefits to which he/she is otherwise entitled.
- All data will be safely stored electronically or in locked filing cabinets and will be destroyed five years after the conclusion of this study.
- There are no reasonably foreseeable risks, harms or inconveniences to participants.

- Participants may benefit from this study by reflecting on their experience completing the online survey. However no direct benefits are promised.
- Participation in the online survey is purely voluntary.
- Participation in the online survey will be deemed to constitute consent to allow that component to be included in this study.

If you have any questions, need further information or at a later time wish to withdraw from this study, please contact one of the following:

Gerald Laronde 705 474-3461 x4206 geraldl@u.ca

Dr. Clare Brett (416) 923-6641 x 2596 cbrett@oise.utoronto.ca

A summary of the research results will be available in the fall of 2007. If you wish to receive a copy, please contact Gerald Laronde 705 474-3461 x4206 geraldl@u.ca

Thank you very much for considering this request. Your participation is very valuable and could help improve the experiences of faculty and future students.

If you are interested in participating in this survey please click on the link below.

**http://www.surveyconsole.com/console/TakeSurvey?id=297004&**

Thank you for your participation and hope that this will be of benefit to all of us.

Gerald Laronde

"Some things are so much fun that you want to keep doing them for as long as possible, like a PhD."

## Appendix H: Faculty Online Introduction and Implied Consent

May 1, 2007

**Dear Faculty Member of the University,**

I am a PhD candidate at the Ontario Institute for Studies in Education, University of Toronto. This survey is part of the doctoral and research work that I am conducting. You are invited to participate in an online survey about the integration of information and computer technology (ICT) within teaching in the Bachelor of Education program. As a Faculty of Education professor you will be asked to complete an online survey that takes approximately 20-30 minutes to complete.

It is hoped that through this study may lead to more understanding of the process of the integration of information and communication technology into the Bachelor of Education and possible improvements to faculty development initiatives.

All of the participants of the survey will remain anonymous. Your participation and contribution is appreciated.

**Information**

- Only Gerald Laronde will have access to the survey data. You will remain anonymous with no way of identification. Real names will be removed or changed to codes in all data collected.
- Participant identity will remain completely anonymous and confidential, including in all reporting of results in scholarly publications and public presentations.
- Individuals may refuse to participate or may withdraw, at any time, without penalty or loss of benefits to which he/she is otherwise entitled.
- All data will be safely stored electronically or in locked filing cabinets and will be destroyed five years after the conclusion of this study.
- There are no reasonably foreseeable risks, harms or inconveniences to participants.
- Participants may benefit from this study by reflecting on their experience completing the online survey. However no direct benefits are promised.
- Participation in the online survey is purely voluntary.
- Participation in the online survey will be deemed to constitute consent to allow that component to be included in this study.

If you have any questions, need further information or at a later time wish to withdraw from this study, please contact one of the following:

Gerald Laronde 705 474-3461 x4206 geraldl@u.ca

Dr. Clare Brett (416) 923-6641 x 2596 cbrett@oise.utoronto.ca

A summary of the research results will be available in the fall of 2007. If you wish to receive a copy, please contact Gerald Laronde 705 474-3461 x4206 geraldl@u.ca

Thank you very much for considering this request. Your participation is very valuable and could help improve the experiences of faculty and future students.

Thank you in advance for your time and support. By continuing with this survey, you have provided consent. Please start with the survey now by clicking on the **Continue** button below

Sincerely,

Gerald Laronde

## Appendix I: Faculty Interview Consent Form

May 1, 2007

**Dear Faculty of the University,**

You are being asked to participate in an interview regarding the integration of information and communication technology into your teaching at the University.

I am a doctoral student at the Ontario Institute for Studies in Education of the University of Toronto (OISE/UT). I would like you to participate in a in an interview regarding the integration of information and communication technology into your teaching at the University. My area of research is the integration of ICT into teaching by Faculty of Education professors. I would like your permission to study your contributions and feedback during this interview as part of my doctoral research. The goal of this research is to study the Faculty of Education professors' beliefs and practices with regard to information and communication technology.

For my research, you will be asked to participate in a semi- structured interview with and answer a few questions regarding your experiences in teaching at University. The estimated time for the interview is approximately 45-60 minutes. The interview session will be digitally recorded and later transcribed. All of the participants will remain anonymous and pseudonyms will be used for your name in the research. Your participation and contribution is appreciated.

**Information**

- Only Gerald Laronde will have access to the digitally recorded session including transcripts of the sessions. You will be anonymous in this session with no way of identification. Real names will be removed or changed to codes in all data collected.
- Participant identity will remain completely anonymous and confidential, including in all reporting of results in scholarly publications and public presentations.
- Individuals may refuse to participate or may withdraw, at any time, without penalty or loss of benefits to which he/she is otherwise entitled.
- All data, including digital audio recordings and transcripts will be safely stored electronically or in locked filing cabinets and will be destroyed five years after the conclusion of this study.
- There are no reasonably foreseeable risks, harms or inconveniences to participants.

- Participants may benefit from this study by reflecting on their experience completing the focus group study. However no direct benefits are promised.
- Participation in the interviews is purely voluntary.
- Participation in the interview components will be deemed to constitute consent to allow that component to be included in this study.

If you have any questions, need further information or at a later time wish to withdraw from this study, please contact one of the following:

Gerald Laronde 705 474-3461 x4206 geraldl@u.ca

Dr. Clare Brett (416) 923-6641 x 2596 cbrett@oise.utoronto.ca

A summary of the research results will be available in the fall of 2007. If you wish to receive a copy, please contact Gerald Laronde 705 474-3461 x4206 geraldl@u.ca

Thank you very much for considering this request. Your participation is very valuable and could help improve the experiences of faculty and future students.

Sincerely,

Gerald Laronde

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Consent Form

**I have had an opportunity to read this document and ask questions; all my questions have been answered to my satisfaction. I understand that I will receive a copy of this consent form.**

I, _____ (please print) give my consent to participate in the interview on information and communication technology in the Faculty of Education and have Gerald Laronde digitally record the session.

Signature _____ Date _____

email address _____

## Appendix J: Administration Interview Consent Form

**Dear Dean of the University,**

You are being asked to participate in an interview regarding the integration of information and communication technology into your teaching at the university.

I am a doctoral student at the Ontario Institute for Studies in Education of the University of Toronto (OISE/UT). I would like you to participate in an interview regarding the integration of information and communication technology into your teaching at the university. My area of research is the integration of ICT into teaching by Faculty of Education professors. I would like your permission to study your contributions and feedback during this interview as part of my doctoral research. The goal of this research is to study the Faculty of Education professors' beliefs and practices with regard to information and communication technology.

For my research, you will be asked to participate in a semi- structured interview with and answer a few questions regarding your experiences in teaching at the university. The estimated time for the interview is approximately 45-60 minutes. The interview session will be digitally recorded and later transcribed. All of the participants will remain anonymous and pseudonyms will be used for your name in the research. Your participation and contribution is appreciated.

**Information**

- Only Gerald Laronde will have access to the digitally recorded session including transcripts of the sessions. You will be anonymous in this session with no way of identification. Real names will be removed or changed to codes in all data collected.
- Participant identity will remain completely anonymous and confidential, including in all reporting of results in scholarly publications and public presentations.
- Individuals may refuse to participate or may withdraw, at any time, without penalty or loss of benefits to which he/she is otherwise entitled.
- All data, including digital audio recordings and transcripts will be safely stored electronically or in locked filing cabinets and will be destroyed five years after the conclusion of this study.
- There are no reasonably foreseeable risks, harms or inconveniences to participants.
- Participants may benefit from this study by reflecting on their experience completing the focus group study. However no direct benefits are promised.
- Participation in the interviews is purely voluntary.

- Participation in the interview components will be deemed to constitute consent to allow that component to be included in this study.

If you have any questions, need further information or at a later time wish to withdraw from this study, please contact one of the following:

Gerald Laronde 705 474-3461 x4206 geraldl@u.ca

Dr. Clare Brett (416) 923-6641 x 2596 cbrett@oise.utoronto.ca

A summary of the research results will be available in the fall of 2007. If you wish to receive a copy, please contact Gerald Laronde 705 474-3461 x4206 geraldl@u.ca

Thank you very much for considering this request. Your participation is very valuable and could help improve the experiences of faculty and future students.

Sincerely,

Gerald Laronde

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Consent Form

**I have had an opportunity to read this document and ask questions; all my questions have been answered to my satisfaction. I understand that I will receive a copy of this consent form.**

I, _____ (please print) give my consent to participate in the interview on information and communication technology in the Faculty of Education and have Gerald Laronde digitally record the session.

Signature _____ Date _____

email address _____

## Appendix K: Technical Assistant Interview Consent Form

May 1, 2007

**Dear Technical Assistant at theUniversity,**

You are being asked to participate in an interview regarding the integration of information and communication technology in regards to your experience in working as a technical assistant at the university.

I am a doctoral student at the Ontario Institute for Studies in Education of the University of Toronto (OISE/UT). I would like you to participate in an interview regarding the integration of information and communication technology into your position as a technical assistant at the university. My area of research is the integration of ICT into teaching by Faculty of Education professors. I would like your permission to study your contributions and feedback during this interview as part of my doctoral research. The goal of this research is to study the Faculty of Education professors' beliefs and practices with regard to information and communication technology.

For my research, you will be asked to participate in a semi- structured interview with and answer a few questions regarding your experiences in teaching at the university. The estimated time for the interview is approximately 45-60 minutes. The interview session will be digitally recorded and later transcribed. All of the participants will remain anonymous and pseudonyms will be used for your name in the research. Your participation and contribution is appreciated.

**Information**

- Only Gerald Laronde will have access to the digitally recorded session including transcripts of the sessions. You will be anonymous in this session with no way of identification. Real names will be removed or changed to codes in all data collected.
- Participant identity will remain completely anonymous and confidential, including in all reporting of results in scholarly publications and public presentations.

- Individuals may refuse to participate or may withdraw, at any time, without penalty or loss of benefits to which he/she is otherwise entitled.
- All data, including digital audio recordings and transcripts will be safely stored electronically or in locked filing cabinets and will be destroyed five years after the conclusion of this study.
- There are no reasonably foreseeable risks, harms or inconveniences to participants.
- Participants may benefit from this study by reflecting on their experience completing the focus group study. However no direct benefits are promised.
- Participation in the interviews is purely voluntary.
- Participation in the interview components will be deemed to constitute consent to allow that component to be included in this study.

If you have any questions, need further information or at a later time wish to withdraw from this study, please contact one of the following:

Gerald Laronde 705 474-3461 x4206 geraldl@u.ca

Dr. Clare Brett (416) 923-6641 x 2596 cbrett@oise.utoronto.ca

A summary of the research results will be available in the fall of 2007. If you wish to receive a copy, please contact Gerald Laronde 705 474-3461 x4206 geraldl@u.ca

Thank you very much for considering this request. Your participation is very valuable and could help improve the experiences of faculty and future students.

Sincerely,

Gerald Laronde

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Consent Form

**I have had an opportunity to read this document and ask questions; all my questions have been answered to my satisfaction. I understand that I will receive a copy of this consent form.**

I, _____ (please print) give my consent to participate in the interview on information and communication technology in the Faculty of Education and have Gerald Laronde digitally record the session.

Signature _____ Date _____

email address _____

## Appendix L: Recent B.Ed. Graduate Focus Group Consent Form

May 1, 2007

**Dear Recent B.Ed. Graduate at the University,**

You are being asked to participate in an interview regarding the integration of information and communication technology in regards to your experience in working as a technical assistant at the university.

I am a doctoral student at the Ontario Institute for Studies in Education of the University of Toronto (OISE/UT). I would like you to participate in an interview regarding the integration of information and communication technology into your position as a technical assistant at the university. My area of research is the integration of ICT into teaching by Faculty of Education professors. I would like your permission to study your contributions and feedback during this interview as part of my doctoral research. The goal of this research is to study the Faculty of Education professors' beliefs and practices with regard to information and communication technology.

For my research, you will be asked to participate in a semi- structured interview with and answer a few questions regarding your experiences in teaching at the university. The estimated time for the interview is approximately 45-60 minutes. The interview session will be digitally recorded and later transcribed. All of the participants will remain anonymous and pseudonyms will be used for your name in the research. Your participation and contribution is appreciated.

**Information**

- Only Gerald Laronde will have access to the digitally recorded session including transcripts of the sessions. You will be anonymous in this session with no way of identification. Real names will be removed or changed to codes in all data collected.
- Participant identity will remain completely anonymous and confidential, including in all reporting of results in scholarly publications and public presentations.
- Individuals may refuse to participate or may withdraw, at any time, without penalty or loss of benefits to which he/she is otherwise entitled.

- All data, including digital audio recordings and transcripts will be safely stored electronically or in locked filing cabinets and will be destroyed five years after the conclusion of this study.
- There are no reasonably foreseeable risks, harms or inconveniences to participants.
- Participants may benefit from this study by reflecting on their experience completing the focus group study. However no direct benefits are promised.
- Participation in the interviews is purely voluntary.
- Participation in the interview components will be deemed to constitute consent to allow that component to be included in this study.

If you have any questions, need further information or at a later time wish to withdraw from this study, please contact one of the following:

Gerald Laronde 705 474-3461 x4206 geraldl@u.ca

Dr. Clare Brett (416) 923-6641 x 2596 cbrett@oise.utoronto.ca

A summary of the research results will be available in the fall of 2007. If you wish to receive a copy, please contact Gerald Laronde 705 474-3461 x4206 geraldl@u.ca

Thank you very much for considering this request. Your participation is very valuable and could help improve the experiences of faculty and future students.

Sincerely,

Gerald Laronde

---

Consent Form

**I have had an opportunity to read this document and ask questions; all my questions have been answered to my satisfaction. I understand that I will receive a copy of this consent form.**

I, _____ (please print) give my consent to participate in the interview on information and communication technology in the Faculty of Education and have Gerald Laronde digitally record the session.

Signature _____ Date _____

email address _____

## Appendix M: Preservice Teacher Sample Work ISTE Standards

**Technology Attitude-Knowledge-Skills Set Based on the**
**I.S.T.E National Educational Technology Standards for Teachers & Students**

*Technology Operations and Concepts*

In regards to this lesson, I possessed the required introductory knowledge, skills and understanding of concepts related to the technology known as computers and the Internet. I was able to navigate the Internet, finding an age appropriate activity that dealt with the content manner in a very effective way. I was then proficient in using the quiz lab resource to make an online assessment of the learning expectations. Thus, I feel I was able to relate this information to the students in a very successful manner. However, where I failed with regards to this lesson and in my overall technological experience is to stay abreast of current and emerging technologies. I can do the basics of a lot of software programs, but I am limited in my capacity within each individual program. In terms of ongoing professional development, I will have to develop this aspect.

*Planning and Designing Learning Environments and Experiences*

With regards to this particular lesson, I feel that I scored strongly in the designing of a developmentally appropriate learning opportunity that applied technology-enhanced instructional strategies to support the diverse needs of learners. Doing an on-line quiz is a good way for students to gage their own assessment and successes. As well, the activity portion of the lesson met these criteria because it was an educational game, where the students were supposed to know the content in order to build a cell. It showed the students step by step how to build a cell based on the organelle's functions; thus, their learning expectations were met in a fun, yet challenging way. However, I did not apply current research on teaching and learning with technology when planning this learning environment or experiences. This was my weak point. I assumed that a game set in an educational context would be sufficient for this lesson, as well as my teaching practices on the whole. I will have to research and apply this research to my learning environments and experiences in the future.

Because of the technology inventory activity done during the October practicum, I was strong in identifying and locating technology resources in the school. However, I did not have the opportunity to evaluate them all for accuracy and suitability. During this practicum, I collaborated with fellow teachers in this respect. For instance, when trying to operate a DVD player, I collaborated with another teacher to fix the impending problem that always arising when using the DVD player. In the future I plan on using the brand new Smart Board to teach lessons. One teacher is learning this at the present time; therefore, I plan to collaborate with him to learn the workings of the Smart Board. When using computers and the Internet, I am strong in the realm of management planning of technology resources within the context of learning activities, for I have had a lot of practice with it. However, I think I would not be strong when it comes to other technology (such as digital cameras, video recorders, Smart boards, etc) because I am not as familiar with them.

*Teaching, Learning and the Curriculum*

Upon reflection of the lesson discussed, I am strong in using technology to support learner-centered experiences that address the needs to students. This whole activity was learner

centered, where the students would have to read and figure out for themselves what function went with what organelle. It was also student centered in that the students could do the activity at their own pace because the activity and the quiz would always be present. The students did not feel rushed to complete the activity, or the assessment, if they did not feel they were comfortable to do so. This worked best for the one student who has a learning disability in language. He could work at his own pace, and he was also able to get help when required. Other activities and forms of assessment do not have this kind of flexibility.

Where this lesson, as well as other lessons utilizing technology fall short is in the realm of higher order cognitive skills and creativity. The way I utilize technology, and the ways I generally relay it, is in a lower order, understanding concepts capacity. I tend not to get to creative or make others get too creative when utilizing technology. This is one area where professional development would be an asset.

*Assessment and Evaluation*

For the lesson critiqued for this paper, I was very effective in using technology (i.e. quiz-lab) as an assessment tool. However, when I reflect on all the lessons I have prepared and all the activities I have evaluated, I did not use technology again. I regret this, for among other things, I think it would have made assessment a little easier. In the future I plan to utilize tool such as Mark Book more efficiently to collect and analyze data, interpret results, and communicate findings to improve instructional practice and maximize student learning. Utilizing this software would have allowed me to view trends more effectively. Also, I would have an organized way with which to relay academic information to the parents.

In another lesson, I did apply a different method of evaluation to determine students' appropriate use of technology resources for learning, communication and productivity. Instead of using an online quiz to test their achievement of the learning expectations, I had them use a word program (I believe it was Corel WordPerfect 12) to reflect on how learning and utilizing Geometer's Sketchpad would be beneficial to education. However, I would like to develop and learn more direct ways of technological assessment than the student simply printing out a piece of text.

*Productivity and Professional Practice*

With regards to this aspect of the National Educational Technology Standards for Teachers, I am strong in applying technology to increase productivity, within reason. I do all my lessons on the computer, as well as all my reflections. I also attempt to do all the handouts and assignments on the computer so they can be printed out at a moment's notice. To communicate, I am a frequent user of email. I would rather use email in the evening to communicate with others so that I can finish a lesson, or get an activity completed with guidance instead of waiting until I see the person of interest (in this case my AT) before I can continue. I would like to develop more assessment techniques using the computer, because that would GREATLY increase my productivity.

Unless I am on the university campus, I do not utilize technology resources to engage in ongoing professional practices. When I become an in-service teacher, this is one area of professional development I would like to improve. I did learn the basics of Geometer's Sketchpad while on this practicum, but it was only enough to teach the students Tour 1 and Tour2 of Getting to Know Geometer's Sketchpad. Thus, I need to work on this in the future.

*Social, Ethical, Legal and Human Issues*

When I assigned this assignment and the assessment, I made it a point to inform the students that they were not to go onto any “non-school approved” sites such as downloading sites or websites with illegal information. Thus, I was trying to teach legal and ethical practice related to technology use. As well, when I did the Geometer’s Sketchpad lesson, I had a data projector set up to my computer. Because I do not participate in illegal downloading, and because I do not visit inappropriate websites, when I opened my computer up, the students did not get a glimpse of anything that was anything other than appropriate. Thus, I was successfully modeling (even minimally) legal and ethic technological use. However, I am not strong in developing and using technology resources the affirm diversity. I need to develop this because I know that diversity is key in keeping students engaged and on task. This related to multiple intelligences, therefore, I have to modify my lessons and the technology I use to adapt and help the students learn to their greatest potential.