THE CONCERNS OF ELEMENTARY EDUCATORS WITH THE DIFFUSION OF INFORMATION AND COMMUNICATION TECHNOLOGY IN SCHOOLS

by

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ABSTRACT

The investigation of individual teachers' concerns with regard to diffusion of an innovation in their practice will help assess their needs and facilitate the process of change and the implementation of new innovations for school improvement. This mixed methods study investigates the concerns of elementary educators in one suburban school district in British Columbia with regard to the diffusion and integration of Information and Communication Technology in their teaching.

The quantitative phase of this study included a purposive sample of 14 elementary schools. The quantitative survey, *The Stages of Concern Questionnaire*, identified the concerns of elementary educators with regard to ICT integration in their teaching. The qualitative phase of the study included a stratified purposeful sample of 17 elementary educators with different types of concerns that were set by the quantitative phase. Interviews with these educators further explored the differences and similarities between their views, feelings, concerns, perceptions and personal experiences. The findings of each quantitative and qualitative phase were analyzed separately and then integrated to obtain a deep understanding of the concerns of elementary educators with regard to ICT integration in their practice.

Overall, the study revealed that a large proportion of the participating elementary educators were not fully engaged with ICT integration in their teaching. The research participants identified four major categories of concerns with regard to ICT integration in their practice that included concerns with regard to the philosophy and pedagogy of ICT integration; concerns related to the accessibility to ICT including software, hardware and resource personnel; concerns about infrastructure technical support; and concerns corresponding to the educational integration of ICT in their teaching.

To address elementary educators' concerns with regard to the use of ICT in teaching, staff development departments and change facilitators should continuously monitor teachers' concerns and the process of diffusion of ICT in schools. Appropriate intervention methods that address individual and specific needs of teachers such as meaningful professional development and technical and educational support as well as proper ICT-equipment will help educators to take ownership of their learning and will allow them and their students to benefit from the many opportunities that technology can bring to their classrooms.

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FOREWORD

Innovation, change and concerns are the major keywords that I have discussed in this research study. Interestingly, these elements have also been integral parts of my personal and professional life for as long as I remember, to the point that I now see them as familiar and alluring concepts in my everyday life.

I was in my teenage years when I witnessed a change of regime during the 1979 political upheaval in Iran followed by the closure of universities and borders when I had just graduated from high school. I continued to experience dramatic changes in the country's situation when the war between Iran and Iraq broke out, a war which significantly changed the course of life in both nations. When I left Iran for France in 1983, leaving my family behind, I was about to get immersed in a new life style on my own, and adapt to a different post-secondary academic environment in a European country. However, "change" did not cease to follow me or perhaps I was following "change" when I married and moved to Canada with my husband five years later. This time, I landed in an English speaking province in Western Canada where North American life style was quite distinct from the European one and the language and academic schooling were also different from my past experience. When I defended my Masters thesis in biochemistry in 1991 at Simon Fraser University, I was also expecting my first child. A career in teaching allowed me to simultaneously contribute to my community in a meaningful way, discover the world of motherhood and my new country of residence as well as continue with a personal and familial tradition of remaining socially active in the community no matter where in the world. The academic and professional switch from pure sciences to the field of education was a major change by itself!

Obviously, the changes that I went through in the past and I continue to experience today have sometimes been beyond my control and other times have been of my own volition. Many of these changes no matter where I lived, exposed me to new ideas and discoveries, some innovative in nature evoking pleasant, refreshing and enlightening feelings, others creating moments of deep thinking and reflection, sometimes painful or even disappointing. I have to admit that all the changes that I have experienced in life have created different levels of concerns in me. It is only now that I realize that depending on the type and intensity of the concern triggered in me by a particular change, I have reacted differently in a variety of circumstances, which has consequently led to outcomes that were either desirable and cherished, or questionable and not in line with my expectations. Some types of concerns have been informative in nature leading me toward more discoveries and a deeper learning experience, allowing me to push myself beyond my comfort zone and immerse in the wonders of life. As for some other concerns, they have been purely personal, for which I did not have the necessary skills to be able to prevent them from holding me back, for which I truly needed more knowledge and probably support. It was then that I realized how different systems of thinking in different parts of the world dealt with people's concerns, and why a variety of informative, preventive and intervention models and programs were devised when the well-being of people was the principal goal of the governing paradigms.

When I finally had the opportunity to examine certain aspects of my practice at the doctoral level, it seemed that my past experiences in life were infused in the way my research study was shaping and moulding. I wished to be able to look at a certain aspect of my teaching practice from both a scientific viewpoint and a more holistic approach. I hoped that my work would analyze the concerns of my colleagues when an innovative educational approach was introduced to them, and more importantly that they received the proper support that would allow them to meaningfully reinforce their students' learning through the new approach. It was then that I decided to focus on educational information and communication technology as an innovation, and study its diffusion at elementary level.

The growing impact of technology on every day life is not a mesmerizing surprise anymore. I, like everyone else had been exposed to it throughout my life in different ways: the informative and communicative impact of technology, I had first experienced as a teenager through the flyers, the tapes of the revolutionary speeches, videos arriving from the outside world and many other forms of technology feeding and shaping a historical event in 1979; its destructive side, I endured during the war between Iran and Iraq; its adventurous side, I enjoyed by travelling from one country to the next; its personal benefits, I cherished while communicating with family and friends around the world; its scientific capacity, I had the privilege of discovering as a biochemist, and last but not least, its educational use, I continue to learn about as a student and teacher every day.

CHAPTER ONE
INNOVATIVE TECHNOLOGY AND TEACHING PRACTICE

The bird may die

I feel sad,
I feel blue.
I go outside and rub my fingers on the sleek shell of the night.
I see that lights of contact are blocked,
All lights of contact are dark.
Nobody will introduce me to the sun,
Nobody will take me to the gathering of doves.
Keep the flight in mind,
The bird may die.

-Forough Farokhzad
(Translation: Maryam Dilmaghani)

This poem by the contemporary Iranian poet, *Forough Farokhzad* (1935-1967) reminds me of the role which has been universally attributed to teachers for centuries: the holders of knowledge and the guides to the light, without whom, all *the lights of contact are blocked*, *all lights of contact are dark*. Teachers have always been described as extraordinary humans who introduce us to the sun, take us to the gathering of doves, and teach us the skills to fly high. These qualities are surely the ideals of any individual including myself who chooses a career as a teacher. However, in today's fast-changing and globalizing world, new emerging expectations are beginning to change and transform the traditional role of teachers.

Today as a teacher in pluralistic Canadian public schools, my responsibility as an educator who has to meet different social, emotional and learning needs of diverse groups of students has become even more pronounced. Do I prepare my students for the twenty-first century? Do I have enough knowledge and skill to meet forces behind globalization such as immigration and new technology that are increasingly impacting educational settings? Would I be able to communicate with and teach new generations of children who are native digital speakers? How is my role as a teacher influenced by continuous emerging new demands and breakthroughs? And how will I be supported in my ongoing quest for personal and professional development? My questions and concerns seem to be never ending.

Literature is rich with references to the growing new responsibilities of today's teachers and their changing role, and researchers continue to propose and recommend a variety of models to support educators in their endeavour. A thorough portrayal of this demanding practice by Haddad (2000) draws attention to the difficult profession of teaching that is becoming even more challenging as a result of continuous demographic and socio-economic changes, political reforms, new developments in the field of brain studies and learning, and the emergence of new innovative technologies. In today's world, teachers need to help their students reach higher levels of cognitive skills, and are expected to follow new models of learning where active, meaningful and authentic learning is emphasized and collaborative learning reinforced (Guzdial & Weingarten, 1995; Haddad; Jonassen, 1999; Wegerif, 2002). As Haddad argues, today's teachers deal with a new generation of students who are better informed, more assertive and perhaps in some countries even more combative and aggressive. It is therefore necessary for teachers to continuously update their knowledge and expose themselves to modern channels of information. Teachers need to learn the skills that they require to work with the newest forms of technology which are available in their schools, and be able to function properly in increasingly digitized cultures (Carlson & Gadio,2005; Delors, 1996; Haddad & Draxler, 2005; Pelgrum, 2001).

Teaching and learning could greatly benefit from investigating factors that motivate teachers to try and adopt new and effective teaching methods and strategies as well as exploring the concerns that hold them back from implementing those strategies. As Hall and Hord (1987) explain, improving teaching improves schools. However, they also emphasize that a thoughtful plan is necessary to overcome various challenges that arise when changes are introduced into any systems. In order to positively address the human side of change, Hall and Hord introduce the concerns-based approach that comes from a conceptual framework known as *Concern-Based Adoption Model* (CBAM), first developed by Hall, Wallace and Dossett in 1973. CBAM helps deal with change in a positive way, as it puts emphasis on teachers as human beings who may be affected by the stress initiated by any innovative change. It provides methods and tools to assess and evaluate teachers' feelings and abilities during change, and proposes proper methods of intervention based on their concerns and needs, thus facilitating the adoption process.

The development of CBAM was guided by the extensive research of Fuller (1969) with pre-service teachers' concerns about their teacher education program. Based on his continuous research, Fuller concluded that their concerns developed from a pre-teaching phase where they were not directly concerned about their teaching but mostly expressing feelings about their experiences as college students. In their early-teaching phase, student-teachers' concerns were mostly self-oriented, and included such concerns as self-adequacy, class management abilities, teaching content adequacy and supervisor evaluation. In the late teaching phase, individuals' concerns were more impact-oriented as they were more focussed on their students' learning, understanding and evaluation. Fuller concluded that the expression of concern is developmental in nature and shifts from personal, to task and finally to impact-oriented concerns. As a result, less experienced in-service teachers have more self-oriented types of concerns, and more experienced teachers have more intense impact concerns. Hall, Wallace, and Dossett (1973) discovered that the three sequences of self, task and impact concerns were also present when teachers experienced implementation of innovations, a finding that led to the CBAM. Based on the concern theory, definite categories of concern emerge during a change process, which are common to most innovations. The self-oriented concerns should be resolved in order for impact-concerns to arise. Therefore, proper teachers' support based on individual needs should be an important goal of any educational settings

Teachers as agents and facilitators of change in information technology reform movements "remain the gatekeepers for student's access to educational opportunities afforded by technology: they cannot and should not be ignored." (Haddad & Draxler, 2005, p. 119). According to research, any reform movement that ignores the perceptions and needs of its members usually fails to sustain (Dooley, Metcalf, and Martinez, 1999; Hall and Hord, 1987). The sustainability of a new model is directly related to the rate of its adoption by individuals during the diffusion process, which according to Rogers (1995) depends on the characteristics of innovations as perceived by individuals. Consequently, the way teachers perceive the characteristics of innovative educational technology would affect the rate of its adoption by these educators in schools.

Throughout my doctoral studies, I have been working on achieving a better understanding of my colleagues' challenges and concerns with the diffusion of the new forms of ICT in their practice. This study has also given me an opportunity to investigate the educators' views, feelings, perceptions and experiences with regard to ICT diffusion in schools. As a public school teacher with experience at elementary, middle and secondary levels and in a variety of disciplines, I realize that elementary schools provide the foundations for the later years in a child's schooling. Therefore, I decided to focus my attention on investigating the impact of ICT on elementary educators, and identify and describe their concerns and needs with regard to its integration in their practice.

In the chapters that follow, I present the details of my research and different phases that I have designed to study this subject. In Chapter one, I introduce the research purpose and the questions that I attempt to answer. The significance of this research project is then discussed. I conclude the first chapter by describing the organization of the thesis.

Research purpose

The purpose of this sequential explanatory mixed methods study was to examine the concerns of elementary educators with regard to the diffusion and integration of Information and Communication Technology in their practice. Using Rogers' *Diffusion of Innovations* (1995) and Hall, Wallace and Dossett's *Concerns Based Adoption Model* (1973) as the theoretical framework for this research study, I administered *The Stages of Concern Questionnaire* (*SoCQ*), first developed by Hall, George and Rutherford in 1979 and later revised by George, Hall and Stiegelbauer in 2006, to teachers in a purposeful sample of 14 elementary schools in a School District located in the suburb of Vancouver, B.C. The *SoCQ* was used to measure seven Stages of Concern (unconcerned, informational, personal, management, consequence, collaboration and refocusing), which fall within three categories: Self, Task and Impact types of concerns (Table 1, p. 7). I analyzed the quantitative data obtained through the questionnaire and used the findings to design the qualitative stage of the research, and to formulate an interview protocol designed to inform and expand the quantitative findings and gain knowledge about elementary educators' views, feelings, perceptions of, experiences and concerns with ICT diffusion and integration in their own terms. I proceeded with qualitative data collection using face-to-face interviews of a stratified purposeful sample of 16 teachers and 1 principal.

Table 1: The Stages of concern about an innovation (George, Hall & Stiegelbauer, 2006, p. 8)

IMPACT	6	**Refocusing**	The individual focuses on exploring ways to reap more universal benefits from the innovation, including the possibility of making major changes to it or replacing it with a more powerful alternative.
	5	**Collaboration**	The individual focuses on coordinating and cooperating with others regarding use of the innovation.
	4	**Consequence**	The individual focuses on the innovation's impact on students in his or her immediate sphere of influence. Considerations include the relevance of the innovation for students; the evaluation of student outcomes, including performance and competencies; and the chances needed to improve student outcomes.
TASK	3	**Management**	The individual focuses on the processes and tasks of using the innovation and the best use of information and resources. Issues related to efficiency, organizing, managing, and scheduling dominate.
SELF	2	**Personal**	The individual is uncertain about the demands of the innovation, his or her adequacy to meet those demands, and/or his or her role with the innovation. The individual is analyzing his or her relationship to the reward structure of the organization, determining his or her part in decision making, and considering potential conflicts with existing structures or personal commitment. Concerns also might involve the financial or status implications of the program for the individual and his or her colleagues.
	1	**Informational**	The individual indicates a general awareness of the innovation and interest in learning more details about it. The individual does not seem to be worried about himself or herself in relation to the innovation. Any interest is in impersonal, substantive aspects of the innovation, such as its general characteristics, effects, and requirements for use.
	0	**Unconcerned**	The individual indicates little concern about or involvement with the innovation.

Research questions

I used the following major question to guide this mixed methods research study: *What are the concerns of elementary educators regarding the diffusion and integration of Information and Communication Technology in their practice?*

By identifying the concerns of elementary educators, researchers, staff departments, change facilitators and school principals can design and develop strategies that address the special needs of educators. Therefore, they will be able to facilitate the process of change and promote the adoption of educational technology, which promises to transform teaching and learning (Hall et al, 1973; Hall & Hord, 1987; George et al., 2006).

To guide the quantitative phase of this study, I used the following questions:

1. *What are the proportions of self, task and impact concerns among elementary educators with regard to the integration of Information and Communication Technology in Curriculum?*

It is important to investigate individual teachers' concerns with regard to diffusion of an innovation in their practice (Hall & Hord, 1987). Research shows that schools with a larger percentage of impact type of concerns among their staff are more likely to continue with the adoption of any particular innovation. The data collected from the administration of *SoCQ* enabled me to calculate the percentages of Stages of Concern among elementary school educators in District X , and identify their concern types.

2. *What are the relationships between elementary educators' current*

Stages of Concern and their demographic background?

In order to answer this question, I broke down the elementary educators' concerns about ICT integration by different demographic factors including age, gender, years of teaching experience, education level, years of using computers in practice and number of ICT skills used for personal use and teaching and perceptions of technology expertise. This information revealed the relationship between these demographic factors and educators' Stages of Concern, and highlighted notable factors that had an impact on the diffusion and adoption of ICT integration.

The qualitative phase of this study expanded on the initial findings. I used the following question to guide this phase of the study:

1. What are elementary educators' responses (views, feelings, concerns, perceptions and experiences) toward the diffusion and integration of ICT in their practice?

A qualitative interview of a sample of educators at different Stages of concern offered an opportunity for the participants to express their views and feelings and describe their experiences and concerns in their own terms. In their discussion of the concept of concern, Hall & Hord (1987) explain that each person's perception of a given issue depends on his/her particular characteristics such as "personal make-up, knowledge, and experience" (p. 5), which leads to different types of concern. Furthermore, according to Rogers' *Diffusion of Innovations* (1995), the rate of adoption of an innovation depends on the characteristics of innovations as *perceived by individuals*. As indicated by Hall et al. (1979), "it is the person's perceptions that stimulate concerns, not necessarily the reality of the situation" (p. 5). A qualitative interview of a sample of educators at different Stages of Concern enabled me to understand their personal responses to ICT integration, and investigate whether these responses confirmed their levels and types of concern and involvement with ICT in their teaching.

Significance of the research

I believe the present research as described makes a meaningful contribution to the practice of teaching in the participating district for 5 reasons:

1) This research contributes to an understanding of the concerns of school educators at elementary level with regard to the diffusion of ICT in schools. One of the impacts of continuous technological advances and information technology reform movements in schools is the requirement for professional staff to adopt skills and abilities that help meet challenges and pressures brought on during implementation of ICT. This research provides valuable insight in identifying and describing the concerns of participants at various levels of involvement with ICT in their practice, and studies, compares and contrasts the types and intensity of these concerns in relation with their demographic backgrounds. The level of concerns of individuals is known to directly impact their performance (Hall & Hord, 1987).

2) The study provides evidence to address issues raised by the diffusion of ICT in elementary schools. Complicity and involvement of teaching staff is essential to welcome and embrace any meaningful reform and innovation in

schools (Haddad & Draxler, 2005; Dooley, Metcalf, & Martinez, 1999; Hall & Hord, 1987). Thus, the human factor should be considered as important as hardware and software improvement when allocating funds for integration of ICT in teaching. By identifying and understanding the issues raised by elementary educators the district staff development department is able to target individual concerns of teachers, and design and implement appropriate models based on personal and professional needs and demands.

3) The research provides data and findings for educators to further discuss the relevance and importance of technology to learning and the next generation. Despite the fact that the purpose of this study was not to discuss the importance and relevance of technology in learning but rather to investigate the concerns of elementary educators with ICT integration in their practice, it is hoped that such research will attract the attention of educators (participating in the research or just reading the dissertation) and cause them to reflect on and consider new and innovative approaches (such as educational technology) in their practice, and explore its impacts on students' learning.

4) This work also adds to the body of research completed within the sphere of mixed methods study. The mixed methods research approach has been the topic of discussion by many scholars for the last three decades especially Creswell (2003) and Tashakkori & Teddlie (2003). As a newer design where both quantitative and qualitative data are collected, analyzed and mixed in a single study to answer the research questions, mixed methods research makes it possible to better understand the research problem by providing both precise

measurement of quantitative research and the in-depth and detailed picture of qualitative research. The application of the mixed methods research design in this study highlights the potential of this approach in the field of education.

5) I identify key areas for further research: Overall, research on teachers and innovations gives direction to districts' staff departments as well as teacher training programs to implement policies that are suitable to teachers' needs throughout the process of change and innovative reform. This research does not only help to develop recommendations to meaningfully implement ICT in schools but also predicts and speculates about the needs of teachers in the future with regard to innovative technology that require further research.

Organization of the thesis

In chapter two, I review relevant literature that examines innovation as part of Rogers' *Diffusion of Innovations* (1995), and concerns triggered by change from the stance of *Concern-based Adoption Model* (Hall et al., 1973), both of which were the theoretical framework of this study. My literature review also extends to the status of ICT adoption and integration in K-12 schools at the national and international level, and explores teachers' views, feelings, perceptions, experiences, concerns and needs with regard to ICT diffusion in schools. I also present models and recommendations made by researchers in the field of educational technology that support teachers' professional growth with regard to ICT integration in the context of existing literature.

In chapter three, I describe the general research methodology that guided me in answering my research questions. I outline and justify the mixed methods research design in this chapter, discuss the two phases of the study, the quantitative and the qualitative phases in detail and identify the research methods. The quantitative phase included a two-part questionnaire, *The Stages of Concern Questionnaire* (Hall et al., 1979; George et al., 2006) and a *Demographic Information Questionnaire* that I developed for this study, both of which I used to survey elementary educators. The qualitative phase was carried out by means of face-to-face interviews.

The usage of *SoCQ* produced a set of quantitative data that I analyze in chapter four for three purposes. First, I grouped elementary educators in different Stages of Concern. Second, I investigated the relationship between the Stages of Concern and individuals' demographic background. Finally, using the findings from this phase, I selected a group of educators for the second phase of the study. I conducted interviews with a sample of elementary educators producing a new set of qualitative data, which I analyze in chapter five to complement and expand on the quantitative phase of the study. I then integrate the findings and conclusions of each of the two quantitative and qualitative phases in chapter six where I conduct a more holistic analysis of both sets of findings in the context of the research study as a whole.

I conclude the thesis with chapter seven where I discuss the conclusions and contributions of this study to research and practice as well as its limitations. I also make recommendations based on the findings and make suggestions for further research. The last part of this thesis includes the references to the literature and the corresponding appendices of the results in related chapters.

CHAPTER TWO
THE DIFFUSION OF INFORMATION AND COMMUNICATIONS TECHNOLOGY IN SCHOOLS: A LITERATURE REVIEW

From the side windows in the little cabins and the docking compartment, where I sleep, you see the complete curvature of the Earth against the dark background of the universe. This view is actually my favorite because you see the "Whole" not the "Parts." I always like to see the big picture before deciding or worrying about the pieces. I wish the leaders of different nations could do the same and have a world vision first, before a specific vision for their country.

-Anousheh Ansari[1]

The emergence of Information and Communication Technology and its growing potential in improving and transforming teaching and learning has led countries to invest more in integrating modern technologies and education in order to help individuals develop skills and competencies that they require to function well in information societies (Delors, 1996; Guzdial & Weingarten,1995; Haddad & Draxler, 2005; Rychen & Salganik, 2003). As a result, schools are filling with computers, printers, scanners, digital cameras and latest technical tools and equipments. New positions and centres are created to help teachers

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[1] From the Space blog of Anousheh Ansari, the first Iranian and female private space explorer, written on September 26, 2006, retrieved December 31, 2007 from http://www.anoushehansari.com/blog/092606.php

develop professionally in the area of educational technology. University education departments implement new programs to reinforce the importance of technology, and review and research teams envision the future of learning for children (Browne & Ritchie, 1991; Carlson & Gadio, 2005; Guzdial & Weingarten, 1995; Stuhlmann & Taylor, 1999). However, in the final analysis, it is only the way technology is implemented by educators that determines its impact on students' learning.

With the emergence of new forms of ICT and multi-media, more demands are made on the professional staff to acquire skills and abilities that respond to the implementation of ICT in schools. (Delors, 1996; Haddad & Draxler, 2005; Rychen & Salganik, 2003; Trewin, 2002). It seems that the teacher's role *vis-à-vis* any age group in educational settings is beginning to change and is becoming even more critical in the information age. Teachers have the essential task of guiding and helping students critically sort and order information, which will then be transformed to useful and meaningful knowledge.

Despite the growing number of modern technical tools in schools, the way these new technologies are used by teachers is still not promising (Becker, 1994; Cuban, 2001; Pelgrum, 2001; Plante & Beattie, 2004; U.S. Department of Education, 1999), and needs to be further researched and discussed. The practice of teaching is more than applying technical skills in a classroom (Cuban, 1986), and teachers learning technology skills in workshops does not always lead to the willingness and/or ability to implement those skills in the art of daily classroom teaching (Brown & Ritchie, 1999; Granger, Morbey, Lotherington, Owston & Wideman, 2002). In addition to learning the necessary skills, teachers need to become autonomous and confident in order to transfer and apply the encoded information to their teaching in a pedagogically sound manner that enhances broader learning objectives. As districts continue to infuse newer technologies into their systems, the necessity of understanding teachers' perceptions, feelings and concerns towards the integration of ICT in their practice becomes more apparent. The willingness and involvement of teaching staff is essential to integrating any innovations such as educational technology in schools (Haddad & Draxler, 2005; Dooley, Metcalf, & Martinez, 1999; Hall & Hord, 1987).

In order to answer my main research question: *What are the concerns of elementary educators regarding the diffusion and integration of Information and Communication Technology in their practice?*, I used the literature from a variety of different areas to build a *big picture* of the status of technology reform movements in K-12 schools, and explore educators' personal responses with regard to ICT integration in their practice. To achieve this goal and to obtain a comprehensive understanding of the subject I organized the literature review into two major sections.

In the initial section entitled, *Theoretical framework*, I looked at the literature on diffusion of innovations and change. This study was rooted in the theoretical assumptions espoused by Rogers (1996) concerning the diffusion of an innovation, and Hall, Wallace and Dossett (1973) addressing the human side of change as the result of an innovation. I analyzed the data in this research using consistent frameworks, and derived findings from the use of these two theoretical frameworks to support the research purpose and questions.

In the second section, *Information and communication technologies in schools*, I investigated the actual findings concerning the status of ICT in today's schools, and explored school teachers' personal responses and experiences. As part of this review, I also examined both barriers to ICT integration and the suggested and implemented models that support teachers in their use of ICT in their practice.

Theoretical Framework

In order to answer my research questions, I attempted to build a research design that integrated theory and practice, educational research and teaching in the school system. This design provided a theoretical and methodological framework for my research study in the context of educational technology at the elementary school level. I based my theoretical framework on two theories of *Diffusion of Innovations* (Rogers, 1995) and *Concerns-Based Adoption Model* (Hall et al., 1973), which I used to guide my research. Based on Rogers' *Diffusion of Innovations*, infusion of ICT in schools, which is expected to improve and transform teaching and learning, is considered a diffusion process in which ICT is an innovation. Innovations, based on concerns research, trigger new and different responses amongst individuals who are involved in the change process (Hall et al.; Hall & Hord, 1987; Hord, Rutherford, Huling & Hall, 2006). Individuals' responses or concerns with regard to innovative changes need to be understood and addressed properly. Therefore, teachers as facilitators of change in schools need to be fully supported in order to adopt new pedagogical and educational advantages that are brought by diffusion of ICT in schools. Concerns-based perspectives as discussed by Hall et al. address attitudes and feelings that may be inhibiting teachers from using an innovation, and recommend intervention methods to increase adoption rate by teachers.

Rogers' diffusion of innovations

Rogers (1995) defines *diffusion* as "the process by which an *innovation* is *communicated* through certain *channels* over *time* among the members of a *social system*" (p. 10). Innovation, Communication Channels, Time and the Social System, the four main elements in Rogers' *Diffusion of Innovations* are the identifiable features in any diffusion study and program. The process of diffusion is considered a special type of communication in which a new idea is communicated among individuals, and it basically involves

> (1) an innovation, (2) an individual or other unit of adoption that has knowledge of the innovation or experience with using it, (3) another individual or other unit that does not yet have experience with the innovation, and (4) a communication channel connecting the two units. (p. 18)

Innovation

The first element in Rogers' *Diffusion of Innovations* (1995), *Innovation* is defined as an "idea, practice or object that is perceived as new by an individual or other unit of adoption" (p. 11). Communicating a new idea in a social system creates a degree of uncertainty, which in turn "implies a lack of predictability, of structure, of information" (p. 6). Information helps reduce uncertainty and allows members of a social system to adopt or reject an innovation. As a result, the diffusion process leads to some forms of social change.

The rate of adoption of an innovation according to Rogers (1995) depends on the characteristics of innovations as perceived by individuals such as the relative advantage of the innovation, its compatibility, complexity, trialability and observability. The relative advantage is defined as "the degree to which an innovation is perceived as better than the idea it supersedes…The greater the perceived relative advantage of an innovation, the more rapid its rate of adoption will be" (p. 15). The compatibility is "the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters" (p. 15). When innovations are incompatible, their adoption is slowed down as the adopters need to acquire new value systems, which is in turn a slow process by itself. Complexity is "the degree to which an innovation is perceived as difficult to understand and use" (p. 15). Therefore, the degree of complexity of new ideas will impact the adoption rate by the adopters who need to develop new skills and understanding with regard to those innovations that are not easy to comprehend. The trialability is defined by Rogers as "the degree to which an innovation may be experimented with on a limited basis" (p. 16). This characteristic will allow potential adopters to experiment with the innovation and reduce their uncertainty while they learn more about the new idea. Finally, observability is defined as "the degree to which the results of an innovation are visible to others" (p. 15). This characteristic will allow other individuals to observe and discuss the results of an innovation with the actual adopters, and therefore make quicker decisions concerning the innovation. Another characteristic that describes certain innovations is the concept of *re-invention*, which is defined by Rogers as "the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation" (p. 17). As a result, this characteristic highlights the active process that can accompany the implementation of those innovations that have a variant characteristic or unpredictable quality.

For any educational settings such as schools with the aim of diffusing technology into their system, a review of the innovation characteristics will help facilitate the adoption rate of educational technology by teachers. For example if ICT is perceived by teachers as having greater relative advantage, compatibility, trialability, observabality and less complexity than other innovations, it will be adopted more easily and rapidly in schools.

Communication channels

Communication channels, an important element of Rogers' *Diffusion of Innovations* (1995) is defined as "the means by which messages get from one individual to another" (p. 18). In order to create awareness and knowledge about an innovation, Rogers refers to *Mass media channels* such as radio, television and newspapers, and *Interpersonal channels* that involve direct and more persuasive exchange of information and new ideas between two or more individuals. This element of *Diffusion of Innovations* plays an essential role in the diffusion of any innovation in schools. Schools are social entities where teachers interact and communicate on a regular basis. Therefore, those teachers who have not yet adopted educational technology will rely heavily on the experience of near peers, and only model after them if they are persuaded that ICT will help them do a better job.

Time

The third element of Roger' *Diffusion of Innovations* (1995), *Time* is an important dimension of innovation-decision process, innovativeness of individuals and rate of adoption. The *innovation-decision process* is:

> ...the process through which an individual (or other decision-making unit) passes from first knowledge of an innovation, to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision. (p. 20)

The process consists of a series of actions and choices including knowledge, persuasion, decision, implementation and confirmation that individuals will face during the diffusion of an innovation. The *innovation-decision process* may be influenced by prior conditions, characteristics of the decision-making unit, perceived characteristics of the innovation, and communication channels. During the diffusion of an innovation such as educational technology, *Time* is an important element that is required for larger populations of educators to adopt new educational ideas. Based on the relative earliness/lateness with which an innovation is adopted, Rogers classifies innovation adopters into five categories: innovators, early adopters, early majority, late majority and laggards. However, the rate of adoption is usually measured using an innovation in a system as a unit of analysis rather than an individual as a unit of analysis.

Social system

The fourth element of Roger's *Diffusion of Innovations* (1995), *Social system*, is defined as "a set of interrelated units that are engaged in joint problem-solving to accomplish a common goal" (p. 23). In the context of this research, the system under study is District X. This research may discover whether members/teachers in this system have reached a mutual goal concerning integrating ICT in their practice. As explained by Rogers, innovations adoption can not be explained solely by individual behaviours, as systems have a direct effect on the diffusion process and an indirect influence on their members. As suggested by Roger's *Diffusion of Innovations* (1995) theory, adopters still play an important role in the process of diffusion of an innovation. For example, the way they perceive the characteristics of an innovation will influence the rate of its adoption. Therefore, I added another guiding theory to this research in an effort to address the human side of the changes that are triggered by an innovation. Through my research, I discovered that the human side of change is addressed positively by researchers and facilitators who adopt *concerns-based perspectives* in their studies. The concerns-based approach (Fuller, 1969; Hall & Hord, 1987; Hord, Rutherford, Huling-Austin & Hall, 1987, George et al., 2006) comes from a conceptual framework known as the *Concern-Based Adoption Model.*

Concerns-based adoption model (CBAM)

The CBAM, which was first developed by Hall, Wallace and Dossett in 1973, mainly evolved out of the work of Frances Fuller (1969), a counselling psychologist who proposed the concepts of early and late concerns when studying the concerns of pre-service teachers about their education program. Based on Fuller's work, teachers' concerns developed through a natural continuous sequence that related to their career stages: pre-teaching, early teaching, or late teaching. As a result of this developmental sequence, teachers expressed different kinds of concerns from no-concerns or very low concerns about the specifics of teaching to self-oriented concerns about themselves and their abilities, to task-oriented concerns about their task of teaching, to impact-oriented concerns about the impact of their teaching on students' learning.

The CBAM researchers (Hall et al.,1973) were interested in investigating individuals' reactions during the change process and adoption of an innovation as they believed that change in the educational settings began with individuals, namely teachers or adopters. The seven main assumptions that underlie the CBAM are the parameters that guide the concerns-based approach (Hall & Hord, 1987):

1) Understanding the point of view of the participants in the process is critical.

2) Change is a process, not an event.

3) It is possible to anticipate much of what 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.

7) Everyone can be a change facilitator.

The first priority of concern-based perspectives namely the *Concerns-Based Adoption Model* (Hall et al., 1979) is to understand the concerns of clients with regard to change and innovation. The word *concern* as the key concept in the model's name highlights the human side of the change process, which should not be ignored. The concept of *concern* is defined as:

> The composite representation of the feelings, preoccupation, thought, and consideration given to a particular issue or task...Depending on our personal make-up, knowledge, and experience, each person perceives and mentally contends with a given issue differently; thus there are different kinds of concerns... it is the person's perceptions that stimulate concerns, not necessarily the reality of the situation...All in all, the mental activity composed of questioning, analyzing, and re-analyzing, considering alternative actions and reactions, and anticipating consequences is concern. An aroused stage of personal feelings and thought about a demand as it is perceived is concern. (p. 5)

There are three dimensions in the CBAM (Hall et al.,1973; Hall et al, 1979; Hall, Loucks, Rutherford & Newlove, 1975; Hord et al, 1987) that allow change facilitators to accomplish ongoing concerns-based diagnosis: *Stages of Concern (SoC), Levels of Use (LoU) and Innovation Configurations (IC)*. These three dimensions are independent of each other and demonstrate changing levels of intensity at different stages of innovation. *SoC,* one of the three components of the CBAM, is a major diagnostic tool that helps researchers, change facilitators and staff development departments assess the concerns of individuals during the change process, and recommend appropriate assistance. *LoU,* another diagnostic component of the CBAM, enables change facilitators to monitor and evaluate innovation implementation, and describe different levels of use of an innovation by individuals. *IC*, the third component of the CBAM, helps change facilitators understand and describe the many ways an innovation is used by individuals in their practice, and identify its ideal and acceptable or non acceptable use. Overall, CBAM helps deal with change in a positive way as it puts emphasis on teachers as human beings who may be affected by the stress associated with any innovation. It provides methods and tools to assess and evaluate teachers' feelings and abilities during change, and proposes appropriate methods of intervention based on their concerns and needs.

Teachers go through a series of psychological Stages of Concern before and during the process of implementation of an innovation in their practice. An individual who is concerned about an innovation is in a mentally aroused state about the innovative change. Teachers' concerns about an innovation are developmental in nature, and change and vary in intensity over time as the implementation process progresses (Fuller, 1969; Hall et al.,1987; George et al., 2006). Building on the work of Fuller, the CBAM team conceptualized seven Stages of Concern that teachers might experience during a change process: Awareness, Informational, Personal, Management, Consequence, Collaboration and Refocusing. This theoretical progression is not always followed linearly by teachers who may have concerns at more than one of the Stages of Concern at any given time and with different levels of intensity. Different teachers do not move with the same rate through the seven hypothesized Stages of Concern, and do not exhibit the same level of intensity at different stages. Therefore, teachers' reaction to an innovation is very individualized and depends on their perceptions and attitude and experience with regard to the innovation (Hall et al, 1977). A 35-item questionnaire called the *Stages of Concern Questionnaire*

(SoCQ) was created to determine the seven Stages of Concern for individuals during the change process (Hall et al, 1979). In 2006, the *SoCQ* was revised (George et al.), and the *Awareness* Stage was renamed *Unconcerned* Stage to reflect the lack of concern of individuals about an innovation rather than their lack of knowledge of the innovation.

As shown in Table 1 (p. 7), the seven hypothesized Stages of Concern (Hall et al, 1979; George et al., 2006) convey different types of concerns. The "Self" type concerns can range from little concern or involvement with the innovation (Unconcerned Stage) to some general awareness and interest in the innovation (Informational Stage), and some doubts about the demands of the innovation and the potential role with the innovation (Personal Stage). Self-type concerns evolve around general characteristics, effects, requirement of use and financial or status implications of the innovation. "Task" type concerns refer to the process and task-related issues concerning the use of the innovation. In the Management Stage, participants would typically express concerns about efficiency, organization, management, scheduling and the time demands of the innovation. Consequence, Collaboration and Refocusing stages are "Impact" type concerns and reflect a more advanced level of involvement with the innovation. Throughout these stages, participants' focus shifts to the impact of the innovation on students; cooperation and coordination with other colleagues in the use of the innovation; and finally to a mastery that leads to the exploration of more powerful alternatives to the innovation in use. This stage is in line with the *re-invention* characteristics of innovations as described by Rogers (1995) referring to the unpredictability quality of an innovation, which can be changed or modified by users during the adoption process.

According to concern-based approaches (Hall et al., 1973), it is essential to understand teachers' mental state toward an innovation such as educational technology before and during the implementation process. Teachers' concerns at different Stages of Concern should be addressed properly with the appropriate intervention methods if meaningful adoption of the innovation by individuals is desired.

Information and communication technologies in schools

With the worldwide growing attention to educational technology and significant investments in innovative technology in educational settings, many countries continue to regularly monitor their individual status with regard to ICT implementation, and are eager to compare their own progress with other countries at international level (Pelgrum, 2001). In the following sections, I attempt to explore the status of ICT diffusion in today's schools, and investigate the factors that impact the integration of ICT by teachers in their practice. In my investigation, I am interested in discovering the gap that might exist between the ideal goals concerning educational technology integration in the school systems and the actual fact-based realities at the global and local level. In addition to a wide range of literature, I also refer to two major studies, one at the international level (Pelgrum, 2001) and the other at the national level (Plante & Beattie, 2004). One study is related to *The International Association for the Evaluation of Educational Achievement (IEA)*, and the other study involves *The Information* *and Communications Technologies in Schools Survey (ICTSS)* at the Canadian level. By looking at the state of ICT implementation in the entire K-12 system at the national and international level, I was also able to investigate different aspects of ICT-related issues in today's schools, and use this information when formulating my recommendations for ICT implementation at elementary level.

In the worldwide ICT comparative study made possible by *IEA*, samples of primary and secondary schools in 26 countries including Canada were subject to a survey, to collect information on topics such as infrastructure, curriculum, staff development and management/organization (Pelgrum, 2001). The main objective of this worldwide assessment was to investigate the obstacles that were perceived by educational practitioners as hindering the realization of their ICT-related goals. The study was conducted in three phases: Module-1 (1997-1999) consisted of a school survey; Module-2 (1999-2002) involved case studies of innovative ICT-practices, and Module-3 (2001-2005) consisted of school, teacher and student surveys. As explained by Pelgrum, one of the goals of comparative studies is to explain the observed variations that exist between students and/or schools within countries.

In a similar study in Canada, *ICTSS* aimed at investigating the ICT accessibility and integration in all Canadian elementary and secondary schools including public, private and federal institutions and schools for visual and hearing impaired (Plante & Beattie, 2004). This survey is a census type survey with a cross-sectional design, which was developed by the Government of Canada's SchoolNet Program and in cooperation with the SchoolNet National

Advisory Board, Statistics Canada and with the support of Library and Archives Canada. The data was collected from principals at the national level, and the response rate was 43% representing a total of 6,676 of the 15,541 schools that provided usable information for the survey.

In the following sections, I investigate the status of ICT implementation in schools by referring to those emerging ICT-related topics in the literature that fell within the purpose of this research study, such as the status of ICT accessibility and ICT integration, the impact of school teachers' characteristics and personal responses on ICT integration, the impact of schools' environment on ICT integration and support system for ICT integration.

ICT implementation status in schools: Accessibility

Based on research, the availability of computers and access to Internet encourage teachers to integrate technology in their teaching (Askar & Umay, 2001; Becker, 1994; Rakes & Casey, 2002; Stuhlmann & Taylor, 1999). It is also believed that the proper use of ICT facilitates active learning and helps students acquire higher-level cognitive skills (Gaible, 2001; Guzdial & Weingarten, 1995; Leh & Keeler, 2001; Nunes & Gaible, 2005). Therefore, the necessity of ready access to ICT by teachers and students becomes more important in today's schools.

Based on the results obtained in the IEA study (Pelgrum, 2001), computer availability in schools, which was assessed through the student/computer ratios, differed considerably between countries and school levels. Canada was reported as being well equipped in both primary and lower secondary schools. Overall, secondary schools had more computers than primary schools; however primary schools had a higher percentage of multimedia computers. Pelgrum mentions that many countries have been able to reduce their ratios very rapidly as the result of ICT related national programs. For example, between 1995 and 1998, a typical country in the IEA study had been able to cut their student/computer ratios by a little more than a half. Although a correlation between the level of complaints of education practitioners and the availability of hardware was observed in countries, however, a lack of hardware was still reported as an obstacle to ICT-related efforts even by 40% of respondents working under very favourable conditions. This finding according to Pelgrum should trigger discussions among the decision makers as to whether they should invest on more hardware or optimize the use of the available equipment.

As for the Internet, based on the IEA report (Pelgrum, 2001), in Canada, Finland, Iceland, Singapore and Slovenia, all schools had access to the Internet by the end of 1999. This did not necessarily mean that students used the Internet in these countries. Based on this research, the relationship between the ratios of students to computers with simultaneous access to WWW and the level of complaints of educators in different countries led to a range of responses irrespective of low or high ratios, meaning that the number of computers with simultaneous access to WWW was seen as an obstacle to ICT-related goals implementation by even some respondents who worked in favourable conditions.

At the Canadian level, based on ICTSS results (Plante & Beattie, 2004), one of the most substantial advancements toward ICT integration in Canadian schools was related to the accessibility factor where almost all schools have access to computers and the Internet. Less than 1% of Canadian schools were without computers in the school year 2003/2004 because of various religious, technical or other reasons. More than one million computers were available to a population of 5.3 million students, which represented an estimated median at 5 for the number of students per computer in elementary and secondary schools in Canada and a median of 5.5 for student-to-Internet-connected computer ratio. In British Columbia, the median student to computer ratio was reported to be 5. The one million computers represented an average of 72 computers per school. The ratio of students/computers was not significantly different between Canadian public and private schools, however the ratio was smaller at the secondary level in comparison to elementary schools.

As for the computer type and location, based on ICTSS results (Plante & Beattie, 2004), 94% of computers in elementary and secondary schools in 2003/2004 were desktops, and the proportion of laptops and notebooks was reported between 5 to 7% in all school types, with the exception of private schools with 20% and mixed elementary and secondary schools with 12% of these portable devices available to them. 45% of the computers in Canadian elementary and secondary schools were located in computer labs, 41% in classrooms and 7% in the libraries and other locations respectively. Classrooms were reported being the preferred location for slightly more than half of the computers in elementary schools in comparison with the secondary schools where over half of the computers were located in computer labs.

As explained by Plante and Beattie (2004), well-equipped computers allow for more efficiency and wider range of computer use and applications. The ICTSS reported that computers in Canadian schools were aging. Only in 23% of elementary and secondary schools in Canada, the computers operated with the most up-to-date systems, with secondary schools being better equipped than elementary schools and private schools more up-to-date than public schools. Overall, 54% of computers in elementary and secondary schools operated with medium processor and 29% with low processor speed. However, this did not always cause problems as many software applications used in schools did not necessarily require the most up-to-date systems. Smaller elementary schools had low processor speed computers in comparison with larger elementary schools and any secondary schools. The ongoing maintenance and technical support was reported by ICTSS, as an important factor to sustain the quality use of ICT equipment. Based on ICTSS results, an average of 12 minutes per computer per month was spent on ICT maintenance and technical support in Canadian schools, with 16 minutes per month per computer dedicated to schools with high processor speed computers and 11 minutes in schools with low processor speed computers.

ICTSS (Plante & Beattie, 2004) also reported that the size and the instructional level of Canadian schools had an impact on the availability of software applications to students. Overall, the top five software applications available to students in schools were word processing software, Internet browsers and educational drill and practice programs, spreadsheet and database programs, and presentation software. The least frequently used software in teaching were "software supporting creative works" and "spreadsheets and database software for simple data manipulations and statistical analysis".

ICT implementation status in schools: Educational integration

In this section, I discuss the educational expectations that are raised as the result of the diffusion of technology in the K-12 school system, and explore the status of ICT educational use by educators in schools within the existing literature.

New standards, expectations and curriculum

The way ICT is used by teachers in their practice determines its impact on students' learning (Gaible, 2001; Guzdial & Weingarten, 1995; Leh & Keeler, 2001; Nunes & Gaible, 2005). Teachers' instructional strategies might range from simple skill acquisition expectations to reinforcement of deep and meaningful thinking activities when using the new technologies in their teaching. The continuous impact of technology on different aspects of education has resulted in new emerging standards that guide schools and teachers in their quest for integrating technology into curriculum.

The International Society for Technology in Education (ISTE) is a non-profit professional organization which provides leadership and service to improve teaching and learning by advancing the effective use of technology in K–12 and teacher education (ISTE, 2006, http://www.iste.org). The *National Educational*

Technology Standards (NETS) sets expectations for students and teachers with regard to technology abilities and competence, and establishes performance-based standards and assessments for improving technology competence in pre-service education. The ISTE for Teachers Project is a US Department of Education project that represents the national consensus on what teachers should know and be able to do with technology. Accordingly, teachers should be prepared to meet the following standards: 1) Technology operations and concepts, 2) Planning and designing learning environments and experiences, 3) Teaching, learning, and the curriculum, 4) Assessment and evaluation, 5) Productivity and professional practice, and 6) Social, ethical, legal, and human Issues. For example, the first standard, *Technology Operations and Concepts* expects that teachers demonstrate a sound understanding of technology operations and concepts. This statement is supported by two performance indicators, one related to basic knowledge, skills and understanding of technology concepts by teachers and the second to their continual growth in technology knowledge and skills. Furthermore, the first indicator is evaluated based on *Technology Standards for Students* (ISTE, 2006).

In 2006, The *Technology Standards for Students* (ISTE, 2006) was modified to "*The Next Generation of NETS for Students*" with a stronger focus on skills and expertise and less emphasis on tools. The six broad categories of standards that need to be mastered by students and used as guidelines by teachers when planning activities are: 1) Creativity and innovation; 2) Communication and collaboration; 3) Research and information fluency;

4) Critical thinking, problem solving, and decision-making; 5) Digital citizenship; and 6) Technology operations and concepts.

As indicated by Voogt and Pelgrum (2005), the emphasis of many governments and policy makers on the necessity of instilling lifelong learning competencies in the citizens of tomorrow should have had an impact on the format of the traditional curriculum, which presently does not always include many of the expected competencies that students require to function properly in information societies. The authors, therefore, attempted to examine curriculum changes in ICT-supported pedagogical practices from 28 countries. Their findings would also reveal whether those governments that claim to promote lifelong learning competencies have indeed provided their education systems with ample opportunities to promote curricular changes that support these competencies. Based on their findings, the content of the curriculum in many cases was not new but only delivered in a different way. In many cases, students worked on topics meaningful to them and related to their own life experience. However, the changes observed especially in the whole school curriculum were still very small, which put governments on the spot to review their curriculum and examination requirements if they seek to achieve the positive impacts of innovative practices on students.

Findings from other studies (Becker, 1994; Becker & Ravitz, 1999) showed that the pressure imposed by administrators to cover curriculum content and prepare students for standardized testing forced teachers, (mainly elementary teachers and some other core-subject teachers at middle and secondary schools) to perceive the integration of computer activities in classrooms as a limitation to the time needed to cover a large amount of information as prescribed by the curriculum. The implementation of ICT in curriculum is still perceived as a complex process (Voogt & Pelgrum, 2005). The educational software are still not integrated with the textbooks and not always compatible with the curriculum content and concepts (Voogt, 2003).

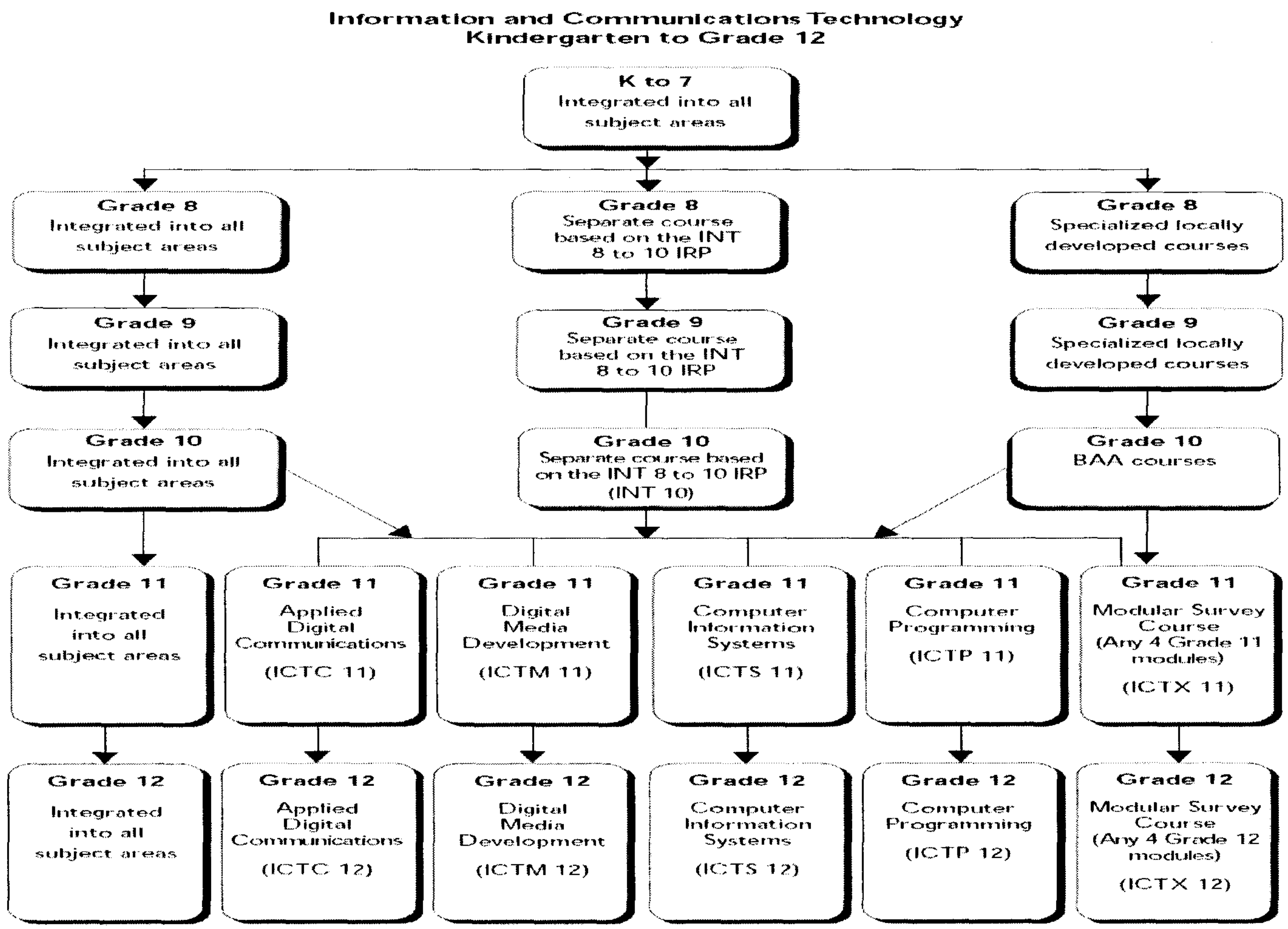
A series of studies (Becker, 1994; Becker & Ravitz, 1999) demonstrated that teachers who used computer technology in their practice became more constructivist and changed their instructional practices towards a constructivist pedagogy. A period of three years, according to these studies, helped computer-using teachers to follow student-centred models more willingly, become more skilled at handling multiple simultaneous activities in class, more interested in engaging students in long projects and more willing to give students more choice of tasks. Many exemplary computer-using teachers replaced the weak or outdated content in the curriculum with new topics. Those teachers who assigned more computer activity time to students believed that a smaller number of topics should be taught in more depth, and did not feel pressured by curriculum coverage (Becker, 2000). They also facilitated more small-group work where students in each team worked together using different software of their choice.

In their analysis of curriculum-related changes in 28 countries, Voogt and Pelgrum (2005) observed a range of variations between the selected cases, and distinguished three patterns: the Single-subject Curricular Focus, the Thematic Curricular Focus, and the School-wide Curricular Focus. In the Single-subject

Curricular Focus, ICT was primarily used to improve existing teaching of discipline-based subjects and understanding of academics subjects' content and concepts. In Thematic Curricular Focus, ICT was used to facilitate the new lifelong learning goals through cross-curricular themes. In the School-wide Curricular Focus, ICT was used to facilitate a new vision on teaching and learning through a school-wide curriculum. Although "the intended curriculum", representing the rationale and goals for learning, was different for these three foci within schools, "the implemented curriculum" (meaning what students and teachers do actually in the classroom), and "the attained curriculum" (describing the learning outcomes for students and teachers) revealed that students worked in similar learning environments no matter what the focus (academic subjects, cross-curricular or school-wide) was, and had the opportunity to work collaboratively on projects, develop positive attitudes and collaborative skills and acquire ICT skills.

In Canadian schools, based on a report prepared for SchoolNet (2001), different provinces have adopted a variety of strategies to implement ICT in schools. Figure 1 (p. 38) is a chart presented by British Columbia ministry of Education in Canada (2008) that proposes various ways that ICT can be delivered in schools across the Kindergarten to Grade 12 system. As evident from this chart, informatics is not a distinct subject at the elementary level but it is integrated in all subjects taught in elementary schools. From Grade 8 to 12, in addition to ICT integration in all subjects, ICT is also taught separately in more specialized courses.

Figure 1: K-12 ICT chart



This chart outlines various ways in which ICT content can be delivered from Kindergarten to Grade 12.

British Columbia Ministry of Education also offers a resource document to teachers, *Information Technology K to 7 Teacher Resource Book* (1996), to support them in their effort to integrate ICT into all of the learning that students are engaged in. It is expected for students to learn the know-how, skills, and attitudes concerning ICT as described in this document, and for the ICT to be integrated in all subject areas. It is also suggested that schools and districts refer to this ICT resource document for necessary requirements towards their technology plans. The *Information Technology K to 7 Teacher Resource Book* (1996) published by British Columbia Ministry of Education divides the prescribed learning outcomes for students into three groups: Foundations, Process and Presentation. As explained in this book, the *Foundations* "provides students with the fundamental knowledge, skills, and attitudes to use information technology tools in all areas of learning." (p. A-2); the *Process* "allows students to select, organize, and modify information to solve problems." (p. A-4); and the *Presentation* "provides students with an understanding of how to effectively use information technology tools to communicate ideas and information using a variety of media." (p. A-7).

Getting Started with Integrating ICT: A Guide for Teachers (2001), revised in 2002, is another publication by the Education Technology Branch of the British Columbia Ministry of Education, which provides guidance to teachers in using ICT in their teaching. *The Information and Communications Technology Integration Performance Standards* for Grades 5 to 10 (2005) support teachers in enhancing learning through the use of ICT processes, tools and techniques across the curriculum. There are two other ICT resources published by BC Ministry of Education, which target students at secondary level to help them acquire the technological and information skills that they require to gather, process and manipulate data.

ICT educational integration status

With all the new ICT-related standards, expectations, guidelines and curricular directions, one might assume that teachers have all the support they need to meaningfully use the ICT tools available to them in schools, and guide students in their learning and equip them with all the skills they require to function in information age. A review of related research might clarify the actual status of ICT integration in schools.

One of the topics addressed by the IEA study (Pelgrum, 2001) at the international level was curriculum indicators, such as the adoption of new pedagogical approaches, emphasis on the acquisition of ICT-related skills and the use of the Internet by students. Based on the results obtained, the student-centred pedagogical approaches that allowed students to be responsible for controlling their own learning process varied considerably between countries, and overall the emphasis in such approaches seemed to be higher in primary than in secondary education. As for ICT skills acquisition, some countries such as Canada, New Zealand and Singapore emphasized the acquisition of ICT skills in primary education substantially more than other countries. Overall, the emphasis on acquiring ICT skills was higher in secondary schools because in many countries, informatics is a scheduled subject, which is not the case in the primary schools. As for the use of the Internet, in some countries like Canada and Finland, both student populations in primary and secondary schools are expected to use the Internet. Many countries reported that despite the increasing investments on ICT, the implementation of ICT in education proceeded at a lower speed than expected, and teachers' lack of ICT knowledge and skills was still perceived by more than half of school principals in most countries as a major obstacle to the realization of schools' ICT related goals.

It is obvious that any instructional reform in education should target students and how their learning improves as a result. Research studies by Becker (1994, 2000) presented some interesting data as to how highly skilful and knowledgeable computer-using teachers could impact students' motivation and enthusiasm for learning. Students of those teachers who integrated technology in their teaching had a tendency to work outside of classrooms on their own time at school, and spent more time on schoolwork at home. By providing students with a positive climate that reinforced deep thinking and promoted research competencies and writing, exemplary computer-using teachers stimulated students to the point that they worked willingly on school projects after class. Therefore, these teachers were successful in enhancing students' aspiration and determination for learning without being supervised-but facilitated by computers.

ICTSS results (Plante & Beattie, 2004) suggest that despite the high ICT accessibility in Canadian schools, less than half of principals in the survey felt that most of their teachers were adequately prepared to effectively engage students in using ICT. This was despite the fact that they reported that 75% of teachers possessed the required technical skills to use ICT for administrative purposes such as preparing report cards, taking attendance or recording grades. A lower proportion of teachers at the secondary level as compared to the elementary level were reported by principals as equipped with the necessary qualifications to meaningfully integrate ICT in teaching. This was explained by the fact that in secondary schools, the teaching of ICT is undertaken by specialist teachers, and requires more advanced skills. A different study by U.S. Department of Education (1999) revealed that despite technically well equipped schools, only 20% of 2.5 million public school teachers felt comfortable using information technology in their classroom at the time of the study.

Based on the reported percentages of comfortable ICT-using teachers in schools (Pelgrum, 2001; Plante & Beattie, 2004; US Department of Education, 1999), one might be interested in investigating the ways that computer-using teachers are involved with computers in their teaching. Ertmer et al. (1999) identified three levels of involvement with computers by teachers in relation to the existing curricula: a) Teachers who use computer as a supplement to the curriculum; b) Teachers who use computer as a reinforcement or enrichment of the curriculum; or c) Teachers who use computer as a facilitator for an emerging curriculum. Moersch (1995) argues that teachers who use computer as supplement, or for either extension activities or enrichment exercises are still at the exploration stages of technology implementation.

In a study carried out by Elliott (2001), 60 student teachers were administered questionnaires to probe the nature of computer experience they encountered after completing a four week teaching practicum on K-2 classrooms in elementary schools in the western suburbs of Sydney. During the four weeks, children's use of computers was estimated as less than 15 minutes per week by 43% of student teachers to 35-45 minutes per week by 16% of student teachers. Computer activities in these classes ranged from word processing to some directed math activities, reading electronic books and some word recognition and spelling. Again, it can be argued that these teachers used technology-based tools toward exploration or isolated instructional activities, rather than integrating them in a manner that provides a rich context for students, enabling them to understand the pertinent concepts, themes, and processes of what was taught (Moersch, 1995).

Cuban (2001) conducted research in six preschool and five kindergarten classrooms in seven Bay Area sites in the United States, which were all considered to have met the National guidelines of developmentally appropriate settings for education of young children. Except for two exemplary computer-using teachers amongst the eleven teachers observed and interviewed, most teachers had limited use of computers during class time and perceived computers as another enrichment activity or learning tool similar to other activities happening at the centre. In another study in the Silicon Valley region, Cuban found that large class sizes and 50-minute class periods at other levels limited teachers in their innovative use of ICT in their teaching, and he observed that teachers hardly changed their routines when using ICT.

Other studies (Becker, 1994; Becker, 2000; Becker & Riel, 1994) revealed that only a very small percentage of computer-using teachers in the United States were actually exemplary in the ways they integrated computers in their teaching. Among the computer-using teachers, those teachers who used computers to encourage students to present information to an audience, communicate electronically with other people and/or learn to work collaboratively were perceived as the most constructivist teachers. However, results from the national American survey (Becker, 1994) revealed that most computer-using teachers used computers to help their students to find information and ideas and express themselves in writing. These objectives still supported a constructivist philosophy of teaching but not to the same extent of the previously mentioned objectives.

If the integration of technology in schools is viewed as an innovation that will affect teachers and students' learning behaviour, it is important for teachers to first embrace the integration of ICT in their own practice, and reconstruct their perceptions of pedagogy to embody new meanings of learning communities in information societies (Elliott, 2001). It is obvious that proper intervention and support programs would help teachers in reflecting on their philosophies and teaching approaches when it comes to new models of ICT-based learning. The lower percentage of teachers integrating ICT effectively in schools (Becker, 1994; Cuban, 2001; Plante & Beattie, 2004; Pelgrum, 2001; U.S. Department of Education, 1999) should shift technology advocates and reformists' attention from pure emphasis on accessibility in schools to investigating reasons behind the inconsistency and unwillingness of many teachers in using the new technology in their practice. In fact, accessibility to technology tools is not sufficient for persuading teachers to use and integrate them in their practice (Marcinkeiwicz, 1994). In order to integrate technology in teaching, factors that impact the integration of ICT in teaching, especially teachers' perceptions, feelings and concerns should also be considered (Hall & Hord, 1987).

The impact of school teachers' characteristics and personal responses on ICT integration

Teachers' perceptions and attitudes toward any innovative change such as educational technology determine whether or not change actually occurs in classrooms (Hall & Hord, 1987). In other words, "for change to be successful, the perceptions of clients (e.g., teachers) must be understood by themselves and by the change facilitators" (p. 6). Teachers alter their practices and embrace technological innovations willingly if they perceive the new tools as helping them do a better job in a realistic fashion, and supporting their students' learning more significantly (Cuban, 1988). Therefore, one could see the impact of ICT on teaching and learning. The complex nature and culture of the teaching profession favours versatile and adaptable instructional tools that respond to unpredictability of classroom life (Cuban, 1988). With teachers' philosophies ranging from teacher-centred to student-centred models in today's schools, teachers' perceptions of ICT usefulness is fundamental to its meaningful integration. As Veen (1993) explains:

> For any educational innovator, it is important to realize that it is not the view of the innovator about the merits of the innovation that matters but rather it is the view of the teachers about the innovation that is critical. If teachers start using computers for 'drill and practice' only, it is probably

> because that use fits their 'routines' best. Their learning process should not be disturbed by telling them that doing 'drill and practice' with computers is only a poor application of information technology. Perhaps, it will be only after two or three years that teachers can gradually enhance their routines and handle more complex applications of information technology (1993, p. 149)

As explained by Hall et al. (1979), concern is defined as the amalgamated preoccupations, perceptions, attitudes and feelings that teachers have toward an innovation. Therefore, studying the concerns of educators with regard to the integration of ICT in their practice would give insight into how their motivations, perceptions, attitudes and feelings have an impact on their willingness to adopt this innovation. Since its origin in 1977 (Hall et al.), many researchers have used the *SoCQ* to measure the seven hypothesized Stages of Concern regarding an innovation. Because of the growing accessibility and awareness of ICT equipment in schools, I decided to focus on the most recent concern studies results to investigate school teachers' concerns with regard to ICT integration in their practice.

Liu and Huang (2005) examined the current trend and pattern of eighty-six in-service teachers' concerns about technology integration, more specifically internet integration, in a graduate course in the summer semester of 2002 at a Midwestern state university. Their results showed intense concerns at informational, personal and refocusing stages, which indicated that teachers' concerns were of both self and impact nature. It seemed that the increasing diffusion of technology had created among these teachers: 1) a group with intense concerns about information related to integrating the Internet into instruction, 2) a group with high concerns about personal commitments such as time, energy and financial issues, and 3) a group of teachers with definite ideas on adopting and/or changing ways to use the Internet based on their experience. The results of this study confirmed Hall et al. (1979) conclusion that related the experience level of the participants to their Stages of Concern: inexperienced teachers had Personal and Informational concerns, experienced teachers developed Consequence concerns, and renewing teachers had Refocusing concerns.

In a study conducted by Rakes and Casey (2002), the concerns of 659 PK-12 teachers toward instructional technology in the United States were analyzed using the *SoCQ*. Results revealed that the two highest Stages of Concern for teachers were intense Personal concerns about instructional technology and Collaboration concerns reflecting their desire to learn from others. Overall, the authors concluded that "the institutionalization of instructional technology in schools has not yet occurred" (p. 8) because many teachers had not yet moved to highest intense levels of concern toward instructional technology, where the meaningful impact on students' learning would be actually achieved. As Hall et al. (1979) explain, earlier concerns should be lowered in intensity before later concerns emerge and increase in intensity, otherwise individuals might discontinue the use of the innovation. The authors also argued that the institutionalization of computers as an instructional tool would not occur if teachers did not become more comfortable with its use in their teaching and if the focus was only on simple skills acquisition. They suggested that the use of technology in the classroom should be viewed as a change process, which would profoundly impact the behaviour of teachers toward their practice.

In other concerns-based research studies, Askar and Usley (2001) interviewed 37 teachers and 6 administrators from three different schools during an IT innovation in schools in Ankara. These schools had received computers at different points in time ranging from three years to seven years earlier, with one school just starting to use computers. They analyzed data qualitatively by doing content analyses and creating categories. In their study, Askar and Usely observed two different diffusion processes during IT innovation: IT as an instructional tool and IT as a management tool. 30% of teachers they interviewed showed no interest in using computers. Mostly, these teachers were only recently exposed to computers. The remaining teachers interviewed were at different Stages of Concern. 40% of teachers reported self-concerns and 30% had task-concerns. Only one teacher was at consequence stage and focusing on the relevance of computers for students. Therefore, only one teacher was using computers with the goal of making a positive impact on students' learning.

Based on research (Becker, 1994; Becker & Riel, 2000; Granger et al., 2002), successful implementation of ICT in schools is directly linked to individual characteristics of teachers, which range from their beliefs, teaching philosophies and goals to their educational background and ICT skills and experience. As Hall et al. (1979) explain, people perceive a given issue such as an innovative change differently because of their personal and professional background, and as a result react differently to an innovation such as ICT.

Becker and Riel (1998) looked at the relationship between teachers' teaching practices, their teaching philosophy, and the different ways they use computers as part of a national study of the use of computers and educational reform in the United States called *Teaching, Learning and Computing, 1998* . In conducting their research, they surveyed approximately 4,100 fourth through twelfth grade teachers in all subjects from over 1,100 schools. This included a national probability sample of U.S. schools, a purposively drawn sample of schools with high technology involvement and a purposively drawn sample of schools known for their involvement in educational reform activities. Frequency and breadth of teachers' professional communications and interactions with other teachers within their own schools and at other schools as well as their involvement with leadership activities were measured. The authors concluded that the more professionally engaged teachers were, the more likely they were to be using computers in an exemplary fashion when teaching. These findings were also verified by Elliott (1990) who demonstrated that teachers in high-use computer classes were good classroom managers, great organizers and very involved in school activities.

In a study of adoption of computer technology by teachers, Dooley, Metcalf and Martinez (1999) interviewed school principals, superintendent, site technology coordinators, technology trainers, learning specialists, external consultants and a total of 13 high, middle and low-using computer teachers in a district located in Calvert, Texas. They concluded that high users of technology had characteristics that differed from middle and low users of technology. High users of technology according to their research were more likely to be in leadership positions, more motivated and socially active, and were better exposed to communication channels. They also had positive attitudes and favourable coping skills toward change, uncertainty and risk. Middle computer users were more thoughtful, cautious and sceptical and succumbed to peer pressure. Finally, low computer users were less interested, suspicious and resistant. These findings were in agreement with Rogers' (1995) classification and description of innovation adopters into five categories of innovators, early adopters, early majority, late majority and laggards. It seems that teachers' characteristics have an impact on their innovativeness and the relative earliness/lateness with which they adopt ICT in their teaching.

Chambers, Smith, Hardy and Sienty (2001) went even further with their arguments and related computer use to teachers' personality type when surveying a selected sample of 200 Emergency Permit teachers using Myers-Briggs Type Indicator and a questionnaire designed to determine teachers' willingness to use technology. Their findings showed that intuitive-thinking types of personality were more likely to integrate technology in their practice than sensory/feeling types. Although the Permit teachers do not have professional training, it would be interesting to further investigate the relationship between personality type of teachers and their Stages of Concern with regard to ICT integration. These findings must lead to the assumption that Teachers Leaders who according to Becker and Riel (1998) were exemplary computer users had intuitive-thinking types of personality. Hord et al. (1987), however argue that "[p]ersonality type may influence the intensity of people's concerns but will not prevent them from experiencing the typical Stages of Concern" (p. 52). Based on other studies (Becker, 1994, 2000), male teachers spent close to four more hours per week using computers at school and home than their female colleagues, a characteristic that led to their categorization as exemplary computer users in their practice.

Overall exemplary computer-using teachers who used and integrated computers more significantly, had higher levels of technical skills and were more personally engaged with computers in their practice than other computer-using teachers (Becker, 2000; Becker & Riel, 1994). They also had more formal training with regard to educational technology, and had completed more credits and degrees with majors in math, science, social sciences and humanities. These teachers were more likely to exhibit teaching philosophies that reflected a constructivist learning theory, and incorporated teaching strategies consistent with this theory in their practice. Elementary computer-using teachers in these studies were more constructivist than secondary teachers, irrespective of their level of computer use. Teachers' teaching philosophy was usually related to the objectives that they planned to accomplish when using computers with students.

In summary, it seems that exemplary computer using teachers have specific and inherent characteristics such as interest in computing activities and innovative learning (Becker, 1994, 2000). These characteristics seem to be more difficult to extend to other teachers who might have different interests and backgrounds. The concern studies results in general (Askar & Usley. 2001; Liu & Huang, 2005; Rakes & Casey, 2002) confirm the previous national and international survey results (Pelgrum, 2001; Plante & Beattie, 2004), indicating that many teachers are still not comfortable and successful in integrating ICT in their teaching in a meaningful way. However, if the development of Stages of Concern follows its natural sequential journey, proper intervention might create technology-friendly environments that influence more teachers to model exemplary computer using teachers' practice (Becker & Riel, 1994; Hall & Hord, 1987; Hord et al., 2006; Rogers, 1995).

The relationship between specific characteristics of teaching environments and their impact on the presence of exemplary computer-using teachers would give some more insight as to whether improving teaching environments in favour of exemplary computer use would extend exemplary teaching practice to other computer users in schools as well as those teachers who are resistant to educational technology.

The impact of schools' environment on ICT integration

In the study conducted by Becker and Riel (1994), the authors concluded that four factors in teaching environments influence the presence of exemplary computer users: users' collegiality and group work, computer use for consequential activities, organized school support of computer users, and allocation of resources to staff development and computer coordination namely resources needed for effective computer use such as smaller class sizes and necessary software. In other studies, Dooley et al. (1999) stressed the importance of several factors that had an impact on the instructional technology diffusion process including the concerns of personnel and administrative factors.

In fact, as Hall and Hord (1987) explain the success or failure of any change depends on the day-to-day actions, or interventions by change facilitators who through these interventions will understand the dynamics of facilitating change. Based on concerns-based concepts, teachers' move through different Stages of Concern during an innovation can not be forced but only facilitated through appropriate supportive models that target individual needs of teachers with regard to the educational technology in a logical fashion (Dooley & al., Hall & Hord).

Interestingly, the study by Becker and Riel (1994) revealed that the dynamics of the relationship between favourable teaching environment factors and the presence of exemplary computer-using teachers was mutual and interconnected and one influenced the other. For example, exemplary computer-using teachers who worked in favourable school environments created social networks, which in turn impacted school environments positively for computer users. This finding is also supported by Rogers' (1995) *Diffusion of Innovations* that highlights the importance of *Communication Channels* as an important element to help potential adopters make decisions about an innovation. These schools allocated more funds to purchasing computers and software in response to higher demands and pressure from computer-using teachers. These findings also confirmed that districts and school administrators were able to provide teachers with an environment that encouraged and helped the meaningful ICT integration by a larger teacher population.

Educational technology reform has also raised some questions about the format and schedule of schooling that hinder the implementation of ICT. Research (Becker, 2000) indicated that longer teaching blocks of time allowed computer-using teachers to assign more frequent student use of computers during class time. This finding was also verified by Cuban (2001) who argued that the actual schedules did not allow teachers to modify their routines in order to integrate ICT in their practice. As for the classroom design, Becker concluded that those teachers who had 5 to 8 computers in their classroom did a better job of providing their students with a variety of research tools than those who scheduled computer labs for their students in different time intervals. It is obvious through the findings of these studies that if educational technology is to be extended to a larger number of teachers, some systemic changes in the school schedules and schools buildings should be undertaken.

Finally, educational technology brings about new sets of problems and challenges for administrators and districts (Becker, 1994). The more knowledgeable and experienced computer using teachers are, the more sophisticated their demands will become. They would expect more space to be allocated to computers, which need to be upgraded regularly, better educationally compatible software, more training on integrating computers in teaching and allocation of funds for personal computers to be used at home.

ICT integration support system

There are many factors that influence teachers' use of ICT in their practice the investigation of which would reveal reasons behind the inconsistency of technology use by the teaching personnel despite the increasing availability of technological resources in schools. Based on concern-based research (Askar & Usley. 2001; Atkins & Vasu, 2000; George et al., 2006; Hall et al., 1973; Hall et al., 1979; Hall & Hord, 1987; Liu & Huang, 2005; Rakes & Casey, 2002), change-facilitators such as administrators and pre- and in-service teacher training programs and staff and professional development departments should consider the range of teachers' needs and expertise with respect to educational technology if they aim at helping them adopt the new educational tools. Based on the work of Hall et al. (1979), Rakes and Casey (2002) argue that the use "... of a concern-based training model rather than a skills-based training model is one method for addressing attitudes and feelings that may be inhibiting teachers' use of technology" (p. 8). Teachers need to move from lower levels of high intensity concerns such as informational and personal to impact levels of concerns if real benefits of educational technology on students' learning are sought.

The importance and impact of appropriate training and technology support on teachers' concern has been studied by Atkins and Vasu (2000) who examined the concerns, knowledge and educational technology use of 155 middle school teachers in three schools in a large district in North Carolina that ranged from low to high level of technology integration. They also explored the relationship between teachers' concerns, knowledge and technology use, and their school's level of technology integration. To conduct their research, they used an adapted version of *SoCQ* as well as the Teaching with Technology Instrument (TTI) (Atkins & Vasu, 1998) which measured teachers' computer competency and use. Based on their results, there was a significant relationship between teachers'

Stages of concern and TTI findings. Teachers with intense early concerns scored low on TTI and worked mostly in the two schools with lower levels of technology integration. The school with higher level of technology integration and better technical support showed significant higher mean TTI scores and presented Management and Consequence type of concern among teachers. Therefore, schools with better technology support systems could achieve their technology-related efforts better. Furthermore, by assessing the training needs of the teachers, better staff development plans could be developed to support schools with integrating technology. Di Benedetto (2005) also stresses the importance of conducting a needs assessment in order to develop training methods that respond to special needs of teachers concerning educational technology.

In other studies, the IEA (Pelgrum, 2001) findings revealed the top ten obstacles to the realization of ICT related goals in schools in different countries in the survey, which were both material and non-material in nature, and starting from the top of the list were as follows: 1) Insufficient number of computers; 2) Teachers' lack of knowledge/skills; 3) Difficult to integrate in instruction; 4) Scheduling computer time; 5) Insufficient peripherals; 6) Not enough copies of software; 7) Insufficient teacher time; 8) WWW: not enough simultaneous access; 9) Not enough supervision staff; 10) Lack of technical assistance.

As evident from the IEA results (Pelgrum, 2001) and as explained earlier, the material conditions such as lack of hardware and software were reported as obstacles to ICT related efforts within schools even in the most favourable environments. Availability of computers, access to Internet and resources allocated to staff development and computer coordination are materialistic factors that encourage teachers to integrate technology in their teaching (Askar & Umay, 2001; Becker, 1994; Browne et al., 1991; Hall & Hord, 1987; Rakes & Casey, 2002; Stuhlmann & Taylor, 1999). As for non-material conditions (Beatty & Plante, 2004; Pelgrum), teachers' lack of knowledge and skills to integrate ICT in teaching is still the most obvious obstacle.

The professional development of teachers as an important factor to accelerate the adoption and implementation of educational ICT in schools, was agreed upon by countries participating in the IEA study (Pelgrum, 2001). However, the results obtained in most countries except for Singapore showed a huge gap between the ideal goal and the reality, when the ideal goal was to train all teachers to use ICT. Favourable staff development conditions and highly knowledgeable technical support personnel who could help facilitate staff development in schools were linked to lower level of complaints of school principals about teachers' lack of ICT knowledge and skills within the surveyed countries in this study.

In order to support teachers in integrating ICT in their practice, various forms of pedagogy and interactive learning dimensions that teachers can use in their practice need to be embedded and modelled in professional development programs with a focus on ICT integration into teaching (Carlson & Gadio, 2005). Twenty first century, which promotes lifelong learning, and advocates transformation of teaching and learning, favours a new emerging paradigm that replaces training with lifelong professional preparedness and development of teachers (Haddad, 2000). This is translated to an ongoing professional and staff development in information-based societies. Buckenmeyer and Freitas (2005) conducted a survey research on 144 educators who participated in educational technology professional development programs and reported that twenty-five to almost forty percent of change in teachers' stage of adoption and use of technology could be explained by three factors: attitude toward technology, available resources and support, and professional development.

In a different research study, Dean (2001) studied the impact of a teacher-focused integration program on teachers, which involved seventy hours of in-depth training conducted outside of teachers' school districts. Results demonstrated that teachers' attitudes towards computers, self-efficacy and experience, measured on a pre to post test basis, were significantly improved following the training program. Teachers came to believe that students' learning was positively impacted by technology as the result of their training. Teachers' responses also revealed that school districts did not contribute significantly to their infusion efforts despite the fact that they described themselves as collaborative, mentoring, confident integrators of technology. Rowland et al. (2001) carried out five case studies of K-12 schools/districts, which were known for their exemplary technology and professional development programs. Their studies revealed the following features of effective professional development programs that promote the use of educational technology: ongoing substantial support by the school district, commitment of resources, leadership with a clear vision, clear communication, meeting the real needs of participants and partnerships. Even though good models of professional development are being developed to motivate and support teachers in their practice, teacher's participation is still key to the success of these models.

Overall, research (Granger et al., 2002) shows that teachers prefer informal mentoring, co-constructed collaborative and "the just-in-time" learning when it comes to technology. Dooley et al. (1999) recommend the formation of interdisciplinary teams/cluster of teachers with one technology leader on each team facilitating technology infusion in schools. They also support a collegial mentor program for new and low computer-using teachers. They argue that middle computer users helping low users create a less intimidating environment where a teacher would be able to work closely with more compatible colleague in terms of knowledge and skills.

In order to motivate many teachers who for different economic, familial or educational obligations are reluctant to embrace time-consuming activities concerning technology, some extrinsic and intrinsic incentives such as technology-focused certification by ministry of education, recognition and time allocation by supervisors, reduced isolation and increased professional satisfaction, and enhanced productivity have been used successfully in the past (Carlson & Gardio, 2005; Haddad, 2000). It is also recommended by Haddad that teachers' upgrading and in-time recertification be supported and facilitated by education authorities on an ongoing basis.

In summary, for purposeful integration of ICT and education and higher teachers' participation, training and professional development programs should be iterative, ongoing and empower teachers and expose them to a variety of learning strategies in order to promote higher-order thinking skills in authentic learning environments (Browne & Ritchie, 1991; Carlson & Gadio, 2005). Furthermore, such programs should embody a modular structure that adapts to different levels of teachers' experience and expertise concerning ICT. They should also provide teachers with social and cooperative opportunities that will help them build learning and sharing communities. According to World Link program (Carlson & Gadio), teachers require a minimum of 80 hours of professional development in order to start integrating technology into their practice.

Summary and conclusions

In this chapter, I discussed the two theories that guided this mixed methods study, *Diffusion of Innovations* (Rogers, 1995) and *Concern-Based-Adoption-Model* (Hall et al., 1973), and reviewed the existing literature on the status of ICT in schools. Rogers' *Diffusion of Innovations* and CBAM complement each other in the way that one defines features and characteristics of the process of diffusion of an innovation, and the other addresses the human side of the changes that are triggered as the result of this diffusion.

Expanding on the diffusion of ICT in schools, it seems that Canadian schools are well-equipped with computers and students have access to internet at all levels of their schooling. However, Canada is not any different from its counterparts in the international survey with regard to the meaningful integration of ICT by teachers (Plante & Beattie, 2004; Pelgrum, 2001). The low percentage of teachers integrating ICT in their practice raises many questions about factors that impact the rate of adoption of ICT by many school educators in their practice. The introduction of technology into schools can become a critical element to improve teaching and learning (Carlson & Gadio, 2005). As a result, well-designed teacher pre-service and in-service programs that consider teachers' concerns toward educational technology will open doors to new educational opportunities for both teachers and students.

The review of literature concerning the diffusion of ICT and educational technology in schools in this chapter reveals that teachers will be more likely to adopt and integrate technology into their practice if the following are true:

- Districts acknowledge and support the integration of ICT in teaching and the accessibility to well-maintained ICT-based equipment in classrooms.
- Professional development that targets the special needs and concerns of educators with regard to the integration of ICT in teaching is readily available.
- Technical support is provided to teachers.
- Teachers have a good support system such as collaborative peers and supportive administrators within their schools.
- Teachers have a positive attitude toward educational technology; teachers are self-confident and innovative.

In the following chapter, I discuss the research design and the methodology for this research study.

CHAPTER THREE
AN OVERVIEW OF RESEARCH DESIGN AND METHODOLOGY

How can I be aware, see what's around,
If there is no showing light or telling sound?

Molana Jalal-e-Din Mohammad Molavi Rumi
(Translation: Shahriar Shahriari)

This study was based on the premise that the teachers' willingness to adopt ICT as an educational innovation is crucial to successful classroom technology integration. The purpose of this mixed methods study was to investigate the concerns of school educators with regard to ICT diffusion in schools and its integration into their practice. The study was rooted in the theoretical assumptions espoused by Rogers (1995) concerning the diffusion of an innovation, and Hall, Wallace and Dossett (1973) addressing the human side of change as the result of an innovation, as presented in Chapter 2.

In order to answer my major research question, *What are the concerns of elementary educators regarding the diffusion and integration of Information and Communication Technology in their practice?*, I used a two-phase, sequential explanatory mixed-methods approach (Creswell, 2003) to obtain quantitative results on the Stages of Concern of elementary educators using a survey with a sample of elementary schools followed by individual interviews to explore those results in more depth.

In this chapter, I detail the rationale behind the choice of mixed methods research design, which combines quantitative and qualitative approaches to collecting, analyzing, interpreting, and reporting data. I give an overview of both quantitative and qualitative methodology. The results of each phase are then analyzed and discussed in more detail in chapters four and five.

The choice of the research design

A mixed methods research design using both quantitative and qualitative data collection procedures helps expand understanding of a phenomenon from one method to another method (Creswell, 2003). The quantitative and the qualitative findings are thus connected and talk to each other to build a negotiated account of what they mean together. According to Teddlie and Tashakkori (2003), "[a] major advantage of mixed methods research is that it enables the researcher to simultaneously answer confirmatory and exploratory questions, and therefore verify and generate theory in the same study" (p. 15). Johnson and Turner (2003) mention that "[m]ethods should be mixed in a way that has complementary strengths and nonoverlapping weaknesses" (p. 16). Creswell, Plano, Clark, Gutmann and Hanson (2003) define mixed methods research design as follows:

> A mixed methods study involves the collection or analysis of both quantitative and/or qualitative data in a single study in which the data are collected concurrently or sequentially, are given a priority, and involve the integration of the data at one or more stages in the process of research. (p. 212)

In discussions of mixed methods research, pragmatism emerges as the orientation that combines both deductive and inductive thinking by connecting quantitative and qualitative data (Creswell, 2003; Teddlie & Tashakkori, 2003).

Based on four criteria, *implementation* (the implementation of data collection), *priority* (the priority given to quantitative or qualitative research), *integration* (the stage in the research process at which integration of quantitative and qualitative research occurs) and *theoretical perspective*, Creswell et al. (2003) propose six major designs that a researcher might employ when adopting mixed methods research design. The type of design selected for this study is sequential explanatory design.

The sequential explanatory design according to Creswell et al. (2003) is the most straightforward type of the six major mixed methods designs during which the collection and analysis of quantitative data is followed by the collection and analysis of qualitative data. In a sequential explanatory design, the priority is usually given to the quantitative data but in some circumstances, the priority can be qualitative or equally given to both. The two methods are usually integrated during the interpretation phase of the study. The theoretical perspective may or may not be present.

Connecting the quantitative and qualitative phases in mixed methods

In the context of this study, the mixed methods research design helped expand understanding about elementary teachers' concerns toward ICT integration in their practice. Table 2 (p. 65) summarizes the characteristics of the mixed methods research design in this research study.

Table 2: Characteristics of mixed methods design used in this study

	Quantitative Stage	Qualitative Stage
Implementation	Sequential-Quantitative first, Qualitative second	
Priority	QUAN → QUAL (equal)	
Integration	At data interpretation	
Theoretical Perspective	Rogers' (1995) Diffusion of Innovation Hall, Dorsett and Wallace (1973) CBAM	
Purpose	-To determine Stages of Concern of elementary educators with regard to integrating ICT in their practice using the *Stages of Concern Questionnaire* -To investigate relationship between elementary educators' Stages of Concern and demographic factors	-To better understand elementary educators' personal responses to the integration of ICT in their practice, and to identify their concerns in their own terms using face-to-face interviews
Sampling	Purposive sampling	Stratified purposive sampling
Data Collection	Questionnaires	Interviews
Data Analysis	Descriptive and inferential Statistics	Coding and categorizing analysis
Validity	Previous instrument validity Standardized measurement	Triangulation, Peer-debriefing, Self-reflection
Presentation	-Findings from Quantitative and Qualitative phases presented separately in chapters four and five: Data presented as graphs, charts, tables, figures, quotations -Integrated Quantitative and Qualitative findings presented in chapter six: Data presented as quotations, tables, figures	

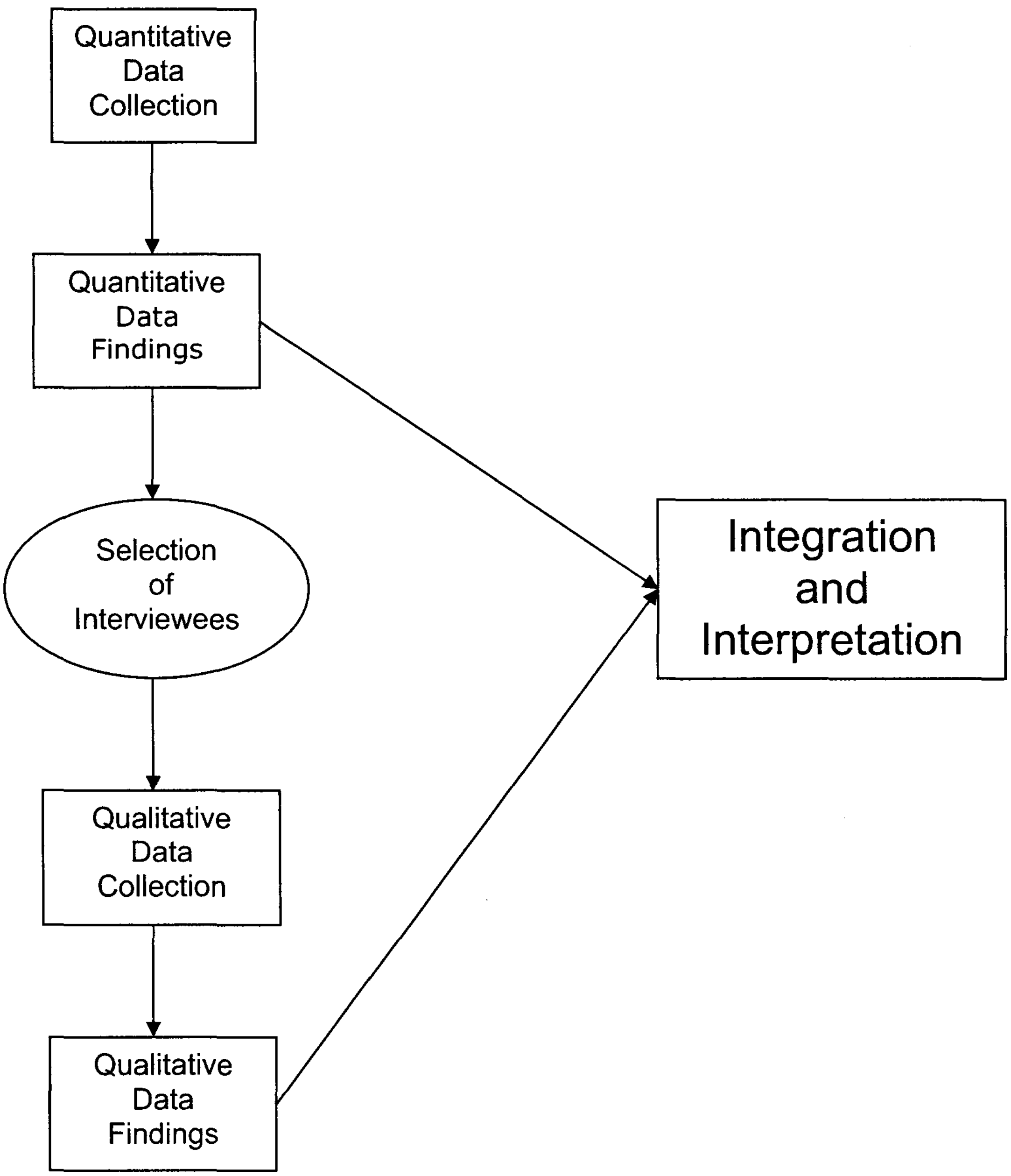
Figure 2 (p. 66) illustrates the visual model that I used to conceptualize the mixed methods sequential explanatory research design procedures in my study where both quantitative and qualitative phases were given equal priority:

$\boxed{\text{QUAN}} \rightarrow \boxed{\text{QUAL}}$

I gave equal priority to both quantitative and qualitative phases in this study, as both phases required extensive data collection and resources, and provided information that was significant in answering the major research question.

In the first phase of this mixed-methods study, I used a quantitative survey research design. In this phase, I collected the quantitative data using self-

Figure 2: Visual model for mixed methods sequential explanatory design procedures in this study



administered questionnaires, which provided basic research evidence in terms of teachers' Stages of Concern as well as identifying statistical relationships between Stages of Concern and different demographic factors. Table 3 (p. 68) provides a summary of the phases in the data collection process in this study. In the data analysis phase of the quantitative stage, I classified respondents into different categories depending on their Stages of Concern (self, task and impact) providing a pool of elementary educators with different perceptions and concerns with regard to ICT integration. The qualitative portion of this study followed a descriptive research design. In this phase, I interviewed a sample of educators from different Stages of Concern. I used the data collected during interviews (Table 3) to round out the picture in order to answer the research question.

While the quantitative phase data determined the Stages of Concern of the respondents, the interviews provided specific examples of elementary school educators' views and concerns about the diffusion of technology in schools, and also helped define their perceptions of computer-based ICT characteristics. The interview with the only volunteer principal provided additional information on ICT integration from a leadership point of view. The qualitative data therefore generated new insight and better comprehension of the phenomenon examined in this research.

Mixed methods data analysis process

Onwuegbuzie and Teddlie (2003) recommend a model for mixed methods data analysis. In their model, they propose seven stages in analyzing mixed methods data: 1) data reduction, 2) data display, 3) data transformation, 4) data

Table 3: Phases in the data collection process for mixed methods research on the analysis of teachers' concerns with the integration of ICT in teaching (Adapted from Table 6.1 in Designing and Conducting Mixed Methods Research study, Creswell, 2007, p. 111)

Phases in the process of Research	Quantitative Data Collection	Qualitative Data Collection
Sampling Procedures	Purposeful sample of 15 elementary schools participating in ICT learning teams	Stratified sample of 16 elementary teachers and one principal from different Stages of Concern identified through the quantitative phase
Permissions needed	-From SFU Board of Ethics -From School District X -From 15 Principals of schools participating in the survey research -From teachers based on voluntary completion of surveys -From SEDL	-From SFU Board of Ethics -From School District X -From individual interviewed teachers
Information to be collected	Instruments: Stages of Concern Questionnaire (George et al., 2006) and Demographic Information Questionnaire (Samiei, 2006)	One-to-one, face-to-face semi-structured interviews
Recording the data	-35-item *SoCQ* using a seven point Likert scale for each item; internal consistency from 0.64 to 0.83 -15-item DIQ providing 5 nominal/categorical data, 2 ordinal data, 7 numerical data and 1 open-ended statement. -Questionnaires discussed with District Technology coordinator and committee members and pilot tested with a purposeful sample of five elementary teachers	-Interview questions including background information, three sets of questions developed based on CBAM and Roger's diffusion of innovation and literature on Teachers and ICT, one final set to exhaust the responses -Interview questions discussed with committee members and pilot tested with one teacher. -Two Olympus DSS players (version 6.2) used to record the interviews. -After each interview, the recorded interview downloaded and saved on the hard drive and on a disk
Administering data collection	-Standardized procedures: One month deadline to complete Questionnaires and return by District Mail to the researcher's school. Introduction and follow-up messages e-mailed to teachers in each school -Ethical Issues attended: voluntary work, envelope for return included, a box of cookies for each school as incentive, thank you message mailed to each school	-An electronic message sent to each volunteer to set up an interview. -Interviews carried in respondents' schools in a quiet room in a friendly and collegial atmosphere -Ethical Issues attended: All the interviewees were informed of the confidentiality of the interviews before and at beginning of the recording, a 5 dollar Thank you Coffee Certificate for each participant given at the end of the interviews

correlation, 5) data consolidation, 6) data comparison and 7) data integration. They mention that if the purpose of the mixed methods research is expansion (which is the case of this study), the researcher may bypass the data correlation, consolidation and comparison stages. Therefore, the three stages for the data analysis in this study were:

- Data reduction: Reducing quantitative data and qualitative data using techniques such as descriptive statistics and exploratory thematic analysis.
- Data display: Reducing quantitative data and qualitative data using tables, graphs, matrices, charts, etc.
- Data integration: Integrating all data into a coherent whole or two separate sets-quantitative and qualitative-coherent wholes.

Miller (2003) attributes four dimensions of inferences for mixed methods: the inferences assumed for the quantitative phase of the analysis, inferences assumed for the qualitative phase of the analysis, the inferential relationship between the two and the possibility of an overall pattern or type of inferential process. In their model, Onwuegbuzie & Teddlie (2003) indicate that the data interpretation stage should be subject to legitimation followed by conclusions and a written final report. In the context of this study, I reduced and displayed data in both quantitative and qualitative phases of the mixed methods research. In order to select a sample of interviewees for my qualitative phase and improve my qualitative phase design based on the shortcomings of the quantitative findings, I needed to analyze the quantitative data first. Then, I conducted the interviews and collected qualitative data that I analyzed during the second phase of my study. This phase was followed by the final stage of my research where I integrated the quantitative and qualitative findings in the interpretation phase of the entire study, to examine the relationship between the two coherent wholes and the possibility of offering an overall pattern that would help with the final recommendations.

Mixed methods report

As recommended by Creswell (2003), the final report of this research study using a mixed methods research design presents two distinct phases with separate headings for each phase. The quantitative phase details the quantitative findings and analysis. This phase is followed by qualitative phase presenting and analyzing the qualitative findings. These two sections are followed with the interpretation phase of the study on how the qualitative findings help extend the quantitative results. I was interested in linking instrument scores from the quantitative study and quotes from qualitative interviews to provide readers with a fuller description and a deeper understanding of the study. For the reader's convenience, I detail the methodology of both phases in this chapter. I then present the quantitative findings, qualitative findings and interpretation of the entire results in chapters four, five and six.

Description of population

With a population of over 30,000 students and 4000 full-time and part-time employees, School District X is a large district in British Columbia, Canada. The district comprises of 53 Elementary Schools, 13 Middle Schools, 8 Secondary

Schools, a Home Education Learning program with 42 students, alternate education programs with 208 students, a Continuing Education Department serving 10,000 students annually, and an International program representing 1063 students form different countries. 7% of the district population are French Immersion students, 3% Aboriginal, 11% are special Education students and over 10,000 students speak a language other than English at home. There are various programs of choice offered by the District, which include Advanced Placement, Career Preparation, French Immersion, International Baccalaureate, Montessori and Online learning.

In this system, in the school year 2006/2007, there were approximately 1,843 educators, with the number of female educators (1,213) almost doubling the number of male educators (629). The average years of education experience was approximately 12 years, and the average age of educators was 43 years. Table 4 (p. 72) shows the demographic breakdown of the educators in District X according to the 2006-2007 British Columbia District Data Summary (http://www.bced.gov.bc.ca/reporting/enrol/teach.php).

According to the 2005/2006 District Performance Plan, the four main goals determined through schools' improvement plans were: *Improving* students' literacy skills K-12, *Improving* students' numeracy skills K-12, *Improving* School graduation and completion rates and *Improving* students' safety and sense of belonging. These goals have been maintained by the District with an ongoing focus on learning. In a 2005/2006 Strategic Direction document, four dimensions of learning were identified by District X: *New literacies, Opportunities for*

Table 4: District X demographic information from the 2006-2007 BC District Data

	Educators	Teachers	Administrators
Total FTE	1,842.5	1723.6	118.9
Gender	**Female:** 1,213.4 **Male:** 629.1	**Female:** 1,154.3 **Male:** 569.3	**Female:** 59.1 **Male:** 59.7
Average age	**Total average:** 42.9 20-24: 6 25-29: 169 30-34: 301 35-39: 346 40-44: 334 45-49: 253 50-54: 330 54-59: 240 60-64: 45 65 or greater: 4	**Total average:** 42.5 20-24: 6 25-29: 169 30-34: 292 35-39: 329 40-44: 311 45-49: 231 50-54: 298 54-59: 215 60-64: 39 65 or greater: 4	**Total average:** 47.7 20-24: - 25-29: - 30-34: 9 35-39: 17 40-44: 23 45-49: 22 50-54: 32 54-59: 25 60-64: 6 65 or greater: -
Average years of experience	**Total average:**12.3 Less than 1: 42 1-4: 332 5-9: 533 10-19: 722 20 or more: 399	**Total average:**11.9 Less than 1: 41 1-4: 331 5-9: 523 10-19: 664 20 or more: 335	**Total average:** 19.8 Less than 1: 1 1-4: 1 5-9: 10 10-19: 58 20 or more: 64

Success, Education in the Global Village and Education to Foster Human Development. Based on the Strategic Plan, the District recognizes advancement of technology in a globalized world and the necessity of new skills and competencies in meeting challenges faced in information-rich societies. As a result, the *Elementary Computer Use Plan*, which was the third District Technology Plan, intended to support issues and challenges identified through the Strategic Plan, and provided schools with a District framework to guide decisions on learning through technology, allocate resources and support schools and teachers in the learning process.

Based on District Technology plans and the 2006 District Strategic plan, the process of diffusion of ICT has been under consideration since 1996. The first District Technology Plan was originated in 1996 with a focus on infrastructure, hardware and software purchase. The second District technology plan completed in 2001, targeted instructional objectives such as facilitating teaching and learning by use of technology, providing staff with technology-based opportunities to develop skills and competencies, and continuing with an ongoing review and assessment of District and schools' needs in technology.

Starting in the spring of 2005, the District launched a number of initiatives to support the diffusion of ICT at all levels:

- Equity initiative to ensure consistency among the 53 elementary schools with regard to access to minimum standards of technology,
- Structural changes to support educational technology by creating two positions, a Technology Staff Development Coordinator and an Administrator of Special Projects,
- New building construction to design new schools and renovate some of the existing ones to be better equipped for ICT use and application,
- One to One Wireless project to explore the effect of instructional technology on students' writing skills,
- Recommended software to align the purchasing and imaging of computers,
- Recommended Hardware to promote standardized hardware acquisition,
- Teacher access to ensure all teachers' access to computers,
- Learning Portal to combine staff non-teaching and teaching tasks and student portfolio management.

In their last Strategic Technology plan in 2006, District X presented a Five-Year plan to balance annual fiscal and staff capacity over a five year period, and recommended that the whole plan be updated annually. In their plan, the District acknowledged that the achievement of the plan without "robust network infrastructure" was not possible, and that they must pay attention to all the components of the Technology Planning Model "from stakeholders to staff development, from applications to policy, from portals to security models". Based on the 2006 K-8 Learning with Technology Strategy, the following presents the vision statement for learning with technology in K-8 system in District X:

> *Learning, teaching and leading will be enhanced through effective and meaningful use of technology.* Effectively implemented and planned use of technology in our schools has the potential to dramatically impact learning, teaching and leading. As technology continues to mature, the primary benefits to teaching and learning are changing from a focus on acquiring the tool in 1996 – 2001; to a focus on integrating the tool from 2001 – 2006; to a focus on using technology as an environment or a platform for learning and teaching in 2006 – 2011.

To support students' learning at all levels, the district has developed different learning models and structures. One innovation in learning focuses on *Learning Through Technology*. In order to integrate technology in curriculum, *Information and Communication Technology Learning Teams* composed of small groups of educators meet on a regular basis to discuss related issues. *Technology Focus Groups* represent another structure that assembles technology educators to identify technical and curricular issues and support teachers with regard to the use of technology. These models and support systems, offered by the Staff Development Department are meant to provide ongoing professional development to teachers who are interested in integrating technology in their practice.

Unit of analysis

Units of analysis according to Babbie (2001) are defined as "those units that we initially describe for the ultimate purpose of aggregating their characteristic in order to describe some larger group or explain some abstract phenomenon" (p. 74). The unit of analysis in this study consists of individual elementary educators, as the purpose of the study is to determine their concerns with regard to the integration of ICT in their practice. The willingness of individual teachers in adopting ICT is critical to the meaningful implementation of ICT-related goals and activities. Furthermore, the process of content analysis in the qualitative phase of this study requires another unit of analysis which is *interview texts* of the responses of 17 elementary educators with regard to ICT integration.

Researcher's role and bias

In this study, my assumptions as well as my biases are based on my own experience as a teacher in the district. In my capacity as a teacher and department head, I have been a member of technology focus groups, and I have organized and been a member of ICT learning teams in my school working to improve and increase the use of educational technology by teachers at the classroom level. Because of my interest in educational technology, I support the meaningful integration of technology in teaching. However, I am also aware of the complex nature of the teaching profession and the obstacles and barriers to the integration of ICT by teachers.

Through my work in different schools at many levels in the district, I have had the opportunity to experience a range of school cultures that view ICT integration differently, and witness various levels of teachers' and administrators' engagement with ICT in their practice. Prior to starting my research, I held the assumption that overall, teachers' personal and professional characteristics, the perceptions and preferences of the school-based leadership concerning ICT integration and the complex nature of teaching had an impact on the ICT adoption rate by educators and its meaningful integration in teaching. I therefore decided to reflect on these assumptions prior to the research data collection, and look at them from many angles and through different lenses to examine how they might impact the results of my work. My role as a teacher and a researcher could also have an impact on the elementary educators participating in this study. To increase neutrality and to maintain an unbiased relation with my colleagues during this study, I maintained a reflective journal where I recorded my questions and reactions throughout the process of my research. I quickly realized that I could easily verify some of my assumptions against the existing literature. I also sustained my neutrality by peer-debriefing and by presenting my results to my dissertation committee at the end of each phase of my study. Throughout the research, I reviewed continuously all the ethical requirements that I needed to consider in order to remain neutral and unbiased.

Phase One: Survey Research Design

For this phase of the study, I used a survey research design to collect and analyze the quantitative data. The following research questions guided me in defining the quantitative phase of this mixed methods study:

1. *What are the proportions of self, task and impact concerns among elementary educators with regard to the integration of Information and Communication Technology in Curriculum?*

2. *What are the relationships between elementary educators' current Stages of Concern and their demographic background?*

In the quantitative phase, I surveyed a purposeful sample of elementary schools in District X in February 2007. The quantitative study enabled me to determine the prevalence of the seven Stages of Concern among elementary school educators in this district with regard to ICT integration. I also looked at the relation between Stages of Concern of elementary teachers and demographic factors such age, gender, experience, degree, grade level, perception of computer expertise, and the amount and types of technology training elementary teachers had received in the past two years. I gave specific attention to determining whether correlations existed among various demographic data and the Stages of Concern reported by teachers.

Different factors make survey research appropriate in answering the main research question in this study (Bourque & Fielder, 1995; Creswell, 2003; Fink, 1995; Fowler, 1988; Gall, Gall, & Borg, 2003; Litwin, 1995). First, this approach, which is considered a non-experimental research, examines phenomena as they exist at one point in time, and helps ensure researchers' neutrality throughout the research procedure. Second, the purpose of such research is to create a detailed description of a phenomenon by means of quantitative or numerical descriptions of some aspects of the study population, and investigate behaviour, cognition and other attributes of individuals without any intervention by researchers. Third, survey research is defined as a quantitative social research, in which the interviewer systematically asks many people the same questions, then records and analyzes their answers. Therefore, survey research allows a standardized measurement consistent across respondents, yielding comparable information about all participants in the survey. The use of a survey research inquiry in the quantitative phase of my research study enabled me to adopt a standardized approach to question a systematically identified sample of elementary educators and assess their concerns with regard to the use of ICT in their practice.

Method of data collection

The method of data collection for the quantitative stage of the research was based on self-administered data collection strategies involving an established questionnaire instrument, *The Stages of Concern Questionnaire* (*SoCQ*) was used to assess elementary educators' Stages of Concern. I also developed the *Demographic Information Questionnaire* (*DIQ*) that I used to obtain demographic information about the elementary educators participating in the first phase of the study.

A self-administered questionnaire is the preferred method of data collection by many researchers because of the economy of the design and its efficiency in collecting data (Fowler, 1998; Gall et al., 2003; Gliner & Morgan, 2000). As indicated by Gall et al. (2003), the self-administered questionnaire is a great method to collect data from teachers because "[t]hey can fill out the questionnaire at their convenience, answer the items in any order, take more than one sitting to complete it, make marginal comments, or skip questions" (p. 222). Fowler (1986) views the visual mode of questions presentation in surveys, and privacy of respondents while completing questionnaires as some potential advantages of self-administered data collection method. However, he also mentions the need for skilfulness in designing questionnaires, linguistic needs of respondents and absence of researchers to monitor the quality of answering process-as interviewers do-as some disadvantages of this technique.

In the following sections, I detail the sampling techniques and the instruments that I used to examine the Stages of Concern of elementary educators.

Sampling procedures/Selection of the participants

For my sample, I selected the elementary schools purposively from a list of district schools that were participating in a variety of learning teams as part of professional development activities offered by the district. Based on Gall et al. (2003), purposeful sampling enables a researcher "to select cases that are likely to be 'information-rich' with respect to the purposes of the study" (p. 165). The purposeful sample identified for this study represented 15 elementary schools that participated in ICT learning teams. These specialized learning teams target a point of inquiry that is related to the meaningful integration of ICT into a defined curricular area as chosen by the group of individuals on the team. Therefore, the 15 schools selected purposefully, suited the purpose of this study. I administered the survey to the entire teaching population in 14 elementary schools accounting for a total of 230 teachers. One school did not participate in the survey.

Instruments

The Stages of Concern Questionnaire developed by Hall, George and Rutherford in 1979 and revised by George, Hall and Stiegelbauer in 2006 (Appendix A, p. 308) is an established survey instrument, which has been used widely by researchers since its origin, to assess Stages of Concern about an innovation. I used this self-administered questionnaire in this research to measure seven hypothesized Stages of Concern elementary educators had regarding ICT diffusion in their schools. George et al. (2006) emphasize in their manual that the questionnaire "was designed for and is intended to be used strictly for diagnostic purposes for personnel involved in the 'adoption' of a process or product innovation. It should not be used for purposes of screening or evaluation" (p. 57). Therefore, the *SoCQ* is not a personality assessment tool, and it only attempts to measure the concerns of individuals as natural and healthy outcomes about any specific innovation.

One of the advantages of using these existing surveys is the fact that they have been designed for and applied to teachers, and their validity and reliability has been established. Therefore, some important factors that can affect the response rate of teachers have already been taken into consideration. For example, the *SoCQ* takes into account that teachers might not have an extended amount of time to respond to complicated questions. It was therefore designed to be completed in ten to fifteen minutes, consisting of only thirty-five items using a seven point Likert scale (Hall et al., 1979; George et al., 2006). As for the validity and reliability of *SoCQ*, the questionnaire developers used Cronbach's alpha to establish the internal validity of the instrument with a sample of 830 teachers and college faculty who were involved with team teaching as an innovation. A sub sample of 132 participants was involved in a test-retest of the instrument over a two-week period. The test-retest correlation results when using the *SoCQ*, ranged from 0.65 to 0.86, and estimates of internal consistency from 0.64 to 0.83 (Hall et al.; George et al.). These results confirm the strong psychometric qualities of this questionnaire and highlight its reliability. An additional strength of this questionnaire lies in its capacity to provide graphic profiles that present levels of intensity in stages of teachers' concerns. As a result, the dynamics of change process and its impacts on teachers could be well monitored, and appropriate methods of intervention implemented.

The Demographic Information Questionnaire (Appendix B, p. 311) is a 15-item questionnaire, which determines educators' characteristics using nominal, ordinal and numerical scales. It contains a range of questions related to teachers' gender, experience, degree, home access to computers and internet, number of computers in class and number of computers connected to the internet, perception of computer expertise, hours of computer training/workshop, type of technology- related activities, number of technology release time by District, as well as a question to assess teachers' technology self-efficacy and an open-ended question with regard to ICT integration in schools. I designed the *DIQ* in 2006 by including those demographic background questions that I believed were useful for my study. The questionnaires package was tested and reviewed by a purposive sample of teachers before being administrated.

Pilot test of the questionnaires

While the questions in the *SoCQ* and their order should not be changed (George et al., 2006), the *DIQ* was open to more modifications if required. In the instruction section of the *SoCQ*, the name of the innovation is to be selected by researchers using the questionnaire. I used the term, *Information and Communications Technology (ICT) Integration in Curriculum* to describe the innovation in this study. The *SoCQ* does not try to hold any one definition of the selected innovation in order for the respondents to think of the innovation in terms of their own perception of what it involves. Therefore *ICT integration* was not defined in *SoCQ* but it was assumed that elementary teachers would mainly think about newer forms of technology meaning computer-based ICT and its peripherals when asked to complete the questionnaire.

Within these parameters, I tested both the *SoCQ* (George et al., 2006) and the *DIQ* for possible revisions based on teachers' feedback. I selected a purposive sample of five teachers based on their gender, grade level and program taught (English or French Immersion). This sample was a reasonable representation of the study sample because my purposive school sample consisted of both French Immersion and regular English programs, and gender and grade level were two of the demographic items that I had considered for

DIQ, which I could easily use to select my colleagues for the pilot test. Furthermore, a sample with a variety of different demographic backgrounds would lead to a variety of common and/or diverse views on issues (Patton, 2001). From these five teachers, one was a bilingual (French/English) female teacher-librarian, the others were a female Grade 1 French Immersion teacher, a female Grade 3 English teacher, a male Grade 4/5 English teacher and Department Head, a male Grade 4/5 French Immersion teacher. The purpose of the pilot test was to evaluate the form, structure and content of each questionnaire as well as the entire questionnaire package including the cover letter for possible areas of confusion, required clarification, as well as ease of completion.

The procedure for pilot test was comprised of two main steps (Gall et al., 2003). First, I asked the teachers in the sample to complete the questionnaires and answer the following questions:

- What do you think about the "The Stages of Concern Questionnaire"? Please add any comments/ suggestions that you might have concerning this questionnaire. How long did it take you to complete "The Stages of Concern Questionnaire"?
- What do you think about "Demographic Information Questionnaire"? Please add any comments/ suggestions that you might have concerning this questionnaire. How long did it take you to complete "Demographic Information Questionnaire"?

- What do you think about the entire questionnaire package? Please add any comments/suggestions that you might have concerning the overall package including the cover letter.

A day later, I interviewed each teacher and discussed their comments with them in more detail. I compiled all the questions and answers discussed during the pilot test in Appendix C (p. 312). To ensure the validity of my choice for the terminology that I used for the *SoCQ* innovation, *Information and Communications Technology (ICT) Integration in curriculum,* I discussed different possible terminologies with the pilot test sample as well as two university professors, one an education policy analyst with previous K-12 teaching experience and another in the field of educational technology. The pilot test results confirmed my assumption that most teachers would think about computer-based ICT when thinking about ICT as well as such important components as the internet.

Overall, none of the teachers reported a significant confusion or misunderstanding when completing the questionnaires. I made some minor revisions as suggested by the participants, mostly to make the cover letter more succinct (Appendix D, p. 318). Teachers found the time needed to complete the questionnaires reasonable.

Survey administration procedure

I sent a message explaining the purpose of the research to the 15 elementary principals of the sample schools. Seven principals granted a meeting. One refused to meet due to the busy schedule and lack of interest of the teaching staff. I went personally to the other seven schools, which did not reply and explained my research purpose in person. After meeting with 14 principals, I received their support.

Different principals had different strategies for delivering the questionnaires and provided me with the numbers of their teaching staff. All of them acknowledged that the survey completion was a voluntary task and the busy schedule of teachers and their different interest levels in the topic would impact the response rate. The general questionnaires' delivery procedure in most cases consisted of three steps: First, I sent a message in advance to the staff of the 14 schools introducing myself, my work and expectations. One principal did not approve of sending a group e-mail to her staff. I then delivered the questionnaires and a box of cookies to each school in February 2007. The questionnaires were administered by school principals to the entire teaching population in the 14 schools. Each school had a month to respond and mail the completed questionnaires to the school where I worked by using an enclosed envelope and the district mail bag. I sent a reminder message to each school closer to the deadline.

Data analysis procedure: Statistical treatment of data

In phase one of this study, I used both descriptive and inferential statistics. The first stage of my statistical analysis consisted of descriptive statistics. I calculated and tallied the *DIQ* responses to represent the number of respondents and their percentiles for each question in the survey. I classified open-ended answers in the additional comment section of *DIQ* into the main categories of concern as expressed by respondents, using qualitative methods of coding and categorizing. I discuss these methods of analysis in detail in the qualitative section of this dissertation.

I then used the *SoCQ* manual for data analysis and interpretation (George et al., 2006) to describe teachers' concerns about the innovation and to answer my research questions for phase one. I analyzed the answers of the surveyed teachers to *SoCQ* using the SOCQ 075 Scoring Program (SAS file, George et al., 2006), which can be accessed using the Statistical Analysis Software (SAS, 2003). This program scores the *SOCQ* and computes the raw scale scores, percentile scores, and group averages. The program is set up to print each individual *SOCQ* profile and then the group profile. Each respondent in the study was assigned a score for each of the Stages of Concern: Unconcerned, Informational, Personal, Management, Consequence, Collaboration, and Refocusing-for which he or she had the highest percentile.

Each of the seven Stages of Concern was represented by five statements from the *SoCQ* (George et al., 2006). The raw score for each scale was the sum of the responses to the five statements for that scale. For example, Stage 0 raw score total was derived by adding the scores for questions 3, 12, 21, 23 and 30. These were then converted to percentile scores for the sample using SOCQ 075 Scoring Program (SAS file, George et al.). It should be noted that the authors highlight the fact that the *SoCQ* interpretations, which are based on numerical data, should only be treated as hypotheses and should be confirmed by respondents and adjusted and adapted accordingly. Therefore, further investigations based on demographic data, open-ended statements and interviews allowed for a more accurate analysis of respondents' Stages of Concern about ICT integration.

The second phase of my statistical analysis consisted of inferential statistics as I focused on the degree of association of Stages of Concern and various demographic variables. In this section, I calculated the appropriate measure of association between Stages of Concern of respondents and each of independent variables: gender, age, level of education, teaching experience, perception of computer expertise, number of hours of technology training during the past two years and number of ICT skills used in teaching and for personal use. Since almost all the respondents had access to home computers and internet, I did not include this variable in the study as it did not provide any useful information. I used contingency table and χ^2 Test of Independence as well as calculating Spearman correlation coefficient to measure the degree of association. I used an alpha level of 0.05 for all statistical tests. For this stage of analysis, data was compiled and analyzed using the computer software Microsoft Excel.

As explained in Table 1 (p. 7), the seven Stages of Concern reflect a range of concerns that an individual might develop when adopting an innovation. I consistently referred to this table when describing and analyzing the Stages of Concern reported by educators in this study.

Reliability and Validity

As indicated by Litwin (1005), reliability "is a statistical measure of how reproducible the survey instrument's data are" (p. 6), and is usually assessed by test-retest, alternate-form and internal consistency. As explained in the previous sections, the alpha coefficients and test-retest correlation results when using the *SoCQ*, confirmed the strong psychometric qualities and reliability of this questionnaire, which has been used widely in many studies over the past 20 years.

As mentioned in literature on Research Design (Creswell, 2003; Gall et al., 2003; Teddlie & Tashakkori, 2003), there are many threats to the validity of a research process that need to be addressed properly in order to obtain valid and reliable conclusions. Creswell recommends that researchers identify threats to four types of validity: *Internal validity*, *External validity*, *Statistical conclusion validity* and *Construct validity* when designing and conducting a research study.

Internal validity Threats are "experimental procedures, treatments, or experiences of the participants that threaten the researcher's ability to draw correct inferences from the data in an experiment" (Creswell, 2003, p. 171). To guard against this, I consistently used the same survey instrument during the experiment. I made all the necessary modifications before the actual administration of the survey as a result of the pilot test. Furthermore, the qualitative stage of my research helped overcome any inadequacies experienced in the first stage of the research. The direction in *SoCQ* clearly informed teachers on how to complete the questionnaire. However, I did not have much control over how elementary educators completed the questionnaires. A persistent follow up routine resulted in collecting all the completed questionnaires within a month from the time they were originally administered. Therefore, the answers provided were based on respondents' first impression during this time.

External validity threats "arise when experimenters draw incorrect inferences from the sample data to other persons, other settings, and past or future situations" (Creswell, 2003, p. 171). In the context of this research, my main focus was the statistical treatments of the elementary educators in my sample, and how the findings would provide me with a pool of volunteers for the qualitative phase of the study. I did not attempt to generalize the results to the entire population of elementary educators in the district.

Statistical conclusion validity threats "arise when experimenters draw inaccurate inferences from the data because of inadequate statistical power or the violation of statistical assumptions" (Creswell, 2003, p. 171). My advantage in the quantitative stage of my research was the fact that I was using the *SoCQ*. As explained before, this questionnaire has been widely used by researchers interested in concerns assessment. The questionnaire has been validated and its reliability tested on a continuous basis. The manual provided considers all the statistical steps that need to be followed by researchers to analyze and discuss the results. I did all the statistical analyses of the *SoCQ* and *DIQ* data and the tests of association using appropriate statistical software.

Construct validity threats "occur when investigators use inadequate definitions and measure of variables" (Creswell, 2003, p. 171). Again, the *SoCQ* and manual provide researchers with precise definitions and statistical strategies to measure and assess the Stages of Concern of elementary educators with regard to ICT integration. Furthermore, the questionnaire wording and definition has already been tested and established. Other articles where researchers have used *SoCQ* also justify the above (Askar & Usley, 2001; Liu & Huang, 2005; Rakes & Casey, 2002). The demographic information included in the *DIQ* was also verified by the dissertation committee members for adequacy and accuracy, and the descriptive statistics was checked many times for validity.

Phase Two: Qualitative Research Design

For this phase of the study, I used a descriptive qualitative research design to collect and analyze qualitative data by interviewing a stratified purposeful sample of 16 elementary school teachers and 1 principal, in May and June 2007 in District X. This inquiry enabled me to obtain a better understanding of the elementary educators' personal responses, meaning their views, perceptions, concerns and experiences with regard to the diffusion and integration of ICT in their practice, which was not possible to achieve in the quantitative phase of the study. By providing a qualitative description of elementary educators' personal responses, this phase may provide an understanding as to why some are receptive of the integration of ICT in their teaching while others still prefer the traditional style of teaching. I used the following question to define the qualitative phase of this mixed methods study:

1. What are elementary educators' responses (views, feelings, concerns, perceptions and experiences) toward the diffusion and integration of ICT in their practice?

The descriptive qualitative research design provided me with a framework for responding to my research question and expanding on the initial findings of the quantitative phase. This method of inquiry enabled me to obtain a comprehensive summary and straight descriptions of the elementary educators' personal responses to ICT integration while I remained close to the descriptive aspects of the words and events evolving from the qualitative data (Sandelowski, 2000; Gall et al., 2003). Qualitative description provides practitioners and policy makers with minimally transformed answers to questions. Some of my questions such as: *"What are your views about ICT integration? What are your feelings about ICT integration? What are your concerns about ICT integration?"* exemplify the type of questions that are asked when descriptive qualitative research design is adopted to conduct a research study (Sandelowski).

Sandelowski (2000) indicates that the descriptive qualitative research design is widely used in practice disciplines to provide a descriptive and comprehensive report of the events in the every day terms of those events. As Patton (2002) indicates "[w]hat people actually say and the descriptions of events observed remain the essence of qualitative inquiry." (p. 457). Sandelowski considers descriptive research design positively as a categorical alternative for inquiry, and less interpretive than "interpretive description", allowing researchers to stay close to their data and preventing the data from being subject to highly abstract conversion and transformation. She argues that qualitative descriptive researchers stay closer to the "surface" of words and events in comparison to researchers conducting newer qualitative inquiries such as grounded theory, phenomenologic, ethnographic, or narrative studies. Describing "surface" as "the degree of the depth of penetration into, or the degree of interpretive activity around, reported or observed events" (p. 336) rather than a metaphor for simple, superficial or worthless, Sandelowski emphasizes the tedious task of the descriptive qualitative researcher who should meticulously assemble the facts in their proper sequence, and accurately convey the meaning attributed to these facts in a cohesive and useful manner, which would reflect the extent of descriptive or interpretive validity of the descriptive study.

Qualitative descriptive research approach is perceived as an inquiry which is the least constrained by philosophical and theoretical commitments, and draws on the general tenets of naturalistic inquiry where no pre-selection or manipulation of variables are sought (Lincoln & Guba, 1985; Sandelowski, 2000). As a result, "Qualitative descriptive designs typically are an eclectic but reasonable combination of sampling, and data collection, analysis, and re-presentation techniques." (Sandelowski, p. 334), a flexibility that in certain cases might lead to qualitative descriptive studies that are designed with overtones from other methods.

The flexibility aspects of the qualitative descriptive research approach allowed me to carry out a stratified purposeful sampling that led to maximum degree of variability in my sample, providing me with information-rich cases (Patton, 2002). As part of the data collection in this descriptive qualitative study, I used structured open-ended individual interviews to discover personal responses of elementary educators with regard to ICT integration in their practice (Sandelowski, 2000). Qualitative content analysis is the strategy of choice for qualitative data analysis and a data-derived approach. Codes are generated from the data itself and data could be represented on its own (Weber, 1990).

Method of data collection

The method of data collection for the qualitative stage of the research was based on a semi-structured interview format following the *General Interview Guide Approach* that uses pre-specified closed-form and open-form questions (Drever, 1995; Gall et al., 2003; Kvale, 1996; Schensul, Schensul, & LeCompte, 1999). This style of interview leads to a formal encounter between the interviewer and interviewee on an agreed upon and on the record subject. Despite its pre-constructed questions, it allows the answers to be open-ended, which enables the interviewee to expand upon them, and the interviewer to encourage broad coverage using prompts and probes, exploring answers in more depth. The interviewee is fairly free to talk and express herself but the interviewer still has some level of control if necessary. As explained by Kvale (1996), a semi-structured interview is "neither an open conversation nor a highly structured questionnaire" (p. 27).

The closed questions in this study allowed me to gather information about demographic data on elementary teachers' professional activities and the availability and accessibility of ICT equipment in their respective schools. I gathered information about the different aspects of ICT integration primarily through open-ended questions followed by a series of probes to elicit additional information. This style of interview allowed the elementary educators to focus on their individual world and reveal their views, feelings, concerns and experiences of the phenomenon of technology in their daily surrounding environment. The participants were not constrained by a structured event in which I asked them to respond to questions in a stimulus-response manner. Through the open-ended questions, I intended to invite general comments rather than definitive answers.

The interviews were face-to-face, one on one and in-person interviews. The adaptability characteristic of interviews is its major advantage over questionnaires. Interviews can reveal deeper reflections of respondents' beliefs and experience with regard to the research questions (Gall et al., 2003; Creswell, 2003). In the following sections, I detail my sampling techniques and the protocol that I used to interview the elementary educators.

Sampling procedure/Selection of the participants

At this point, I had already set the Stages of Concern in the quantitative phase of the study. I had also asked the participants in the survey component of the research if they were willing to be interviewed later. I therefore selected a stratified purposeful sample of educators comprising of 16 teachers and 1 principal from the volunteer pool, aligned with each SoC that was identified in the study, as follows:

- Collaboration Stage 5: I interviewed all three volunteer respondents.
- Management Stage 3: I interviewed all four volunteer respondents.
- Personal Stage 2: I interviewed two volunteer respondents.
- Information Stage 1: I interviewed two volunteer respondents.

- <u>Unconcerned Stage 0</u>: 11 teachers with a wide range of teaching assignments had volunteered for an interview. I selected and contacted a purposive sample of seven teachers with a variety of teaching assignments and from different schools. Five teachers replied and agreed to an interview.
- <u>Unconcerned Innovation Users:</u> Two teachers had volunteered: 1 full time Grade 1 and 2 teacher and 1 intermediate ESL/Gifted/LA teacher who worked part-time (0.5). I selected and interviewed the full time classroom teacher who seemed to be more involved with the every day work at the school.

As explained by Gall et al. (2003), stratified-purposeful sampling enables a researcher to select a “group of cases that represent defined points of variation…in the phenomenon being studied” (p. 638). This sampling procedure led to a diverse population of participants in this study. Diversity is desirable in qualitative studies because it would help to analyze the possible common patterns that emerge from a population with a variety of different demographic backgrounds (Patton, 2002). Teachers selected for the interview in the qualitative phase represented a variety of grade levels, programs (Regular English and French Immersion), teaching assignments and specialties, years of teaching experience and educational background across the Stages of Concern. They were also members of different schools in the surveyed sample (Table 20, p. 146).

Interview Protocol Development

I developed two guidelines (Appendix E, p. 319), one for teachers and one for the principal in the study. The principal guideline was very similar to teachers' guideline but it also allowed the principal to express himself as a leader and a teacher when answering questions.

Guided by my theoretical framework and the literature review on ICT integration and implementation in schools, I designed the semi-structured interviews to capture elementary teachers' personal responses and provided them with opportunities to describe their views, feelings, concerns, experience and perceptions regarding ICT integration. They were also able to suggest various ways that they could be better supported in their ICT use. In summary, I designed the questions in such a way as to make the elementary educators think about the phenomenon of ICT integration in their teaching, and developed the interview guide by referring to Kvale's (1983) twelve goals specific to qualitative interviews. Therefore, each interview was: 1) centred on elementary educators' personal responses to ICT integration, 2) interpersonal, 3) based on an assumption of shared meaning concerning the integration of ICT in teaching, 4) qualitative in nature; 5) descriptive, 6) particular in intent; 7) with no presumptions, 8) supported by minimal ambiguity; 9) able to be altered to encourage broad coverage; 10) focused on ICT integration; 11) sensitive to each elementary educator, and 12) a positive experience for my colleagues.

As explained by Patton (2002), a carefully conceived interview guide can actually constitute a descriptive analytical framework for analysis. I thus developed the interview guides based on three major categories to facilitate the analysis of elementary educators' concerns with regard to the integration of ICT in their practice: (a) General responses (personal views, feelings, concerns) toward the integration of ICT, (b) Personal experience with the integration of ICT, (c) Perception of characteristics of computer-based ICT integration. The two other sets of questions that I designed at the beginning and the end of the interviews were to obtain some additional background information that would complement the interview. The following sections describe each set of questions in more detail:

- The first set of questions was a background check. I designed these questions to double-check teachers' professional background based on the DIQ used in the quantitative phase as well as explore other professional duties that the teachers were involved with beside their daily teaching assignments.

- The second set of questions expanded on the *CBAM*, which was the main theoretical framework for the *SoCQ* in phase one of this study. I designed the questions to allow the respondents to openly express their views, feelings and concerns with regard to ICT integration. I modelled some questions after the sample questions provided by Hall and Hord (1987) and Dooley et al. (1999).

- The third set of questions was based on the outcome of the literature review concerning the use of ICT by teachers, which is presented in the second section of this dissertation. These questions gave the respondents the opportunity to describe their involvement with ICT integration, and give examples of how they used ICT in their teaching. At this stage, I asked teachers to think about the barriers they had encountered while using ICT, and suggest ways they could be better supported in this regard.

- The fourth set of questions expanded on Rogers' *Diffusion of Innovations* and explored the participants' perceptions of the characteristic of computer technology in their practice.
- The fifth and final set of questions added more insight and depth to the interview, and encouraged participants to reflect on the entire interview and add final thoughts. These questions helped reach a point of saturation at which I could not identify any new points of view or concerns by participants.

Pilot test of the interview

According to Gall et al. (2003), it is possible during the pilot testing of interviews, to identify ambiguous and threatening questions and revise them. I discussed my questions informally with the District Technology coordinator who reinforced the importance of adding a question that would help to further investigate barriers that teachers encountered when working with ICT. The interview questions were pilot tested with a school colleague, and also reviewed by my dissertation committee. The teacher was a Grade 1 French Immersion female teacher who had been teaching in the English program at many different levels for many years before switching to the French Immersion Program. She had a bachelors degree and was a member of the school ICT learning team. The interview was tape-recorded in a quiet room, and lasted 30 minutes. Later, I interviewed my colleague a second time about the whole interview process. Overall, she found the questions clear and she liked the fact that I was rephrasing them to clarify things when she was not sure about something. She did not feel intimidated and she had plenty of time and opportunity to express herself. Based on this test, I determined the following:

-The use of follow up questions helped the respondent to express more ideas and give more feedback on a topic.

-Some answers were leading to new questions that were not anticipated and because of the open-ended nature of the interview, I was able to ask them and clarify many points during the interview.

-The interviewed teacher observed that despite the fact that she could express herself freely, she sometimes felt that she needed to say positive things about ICT to please me. I decided therefore to modify my introduction during the interview and begin the interview by telling people that I was not acting as an advocate or opponent of ICT and I only wanted to find out about teachers' genuine views and concerns with regard to ICT integration, and that there was no right or wrong answers to any questions. I therefore modified the introduction (Appendix E, p. 319).

-The format of the interview and the use of open-ended questions highlighted the emphasis on empathy with the interviewees and the necessity for the researcher to develop and sustain a relationship with the interviewees in order to reinforce their cooperation and motivated participation (Creswell, 1998; Gall et al., 2003; Gubrium & Holstein, 2002; Kvale, 1983). Based on the literature on qualitative interview research and the pilot test, I tried to build confidence and create a friendly and empathetic atmosphere in three ways. First, my experience as a teacher in general, and as an elementary teacher in my own district in particular, provided me with the opportunity of developing a sound social and collegial relation with my colleagues early on in the interview process. Second, all the interviewees had volunteered to participate in the interviews of their own free will. I had already developed some relationship with them while I was exchanging e-mails with them to schedule interview dates and times. Third, outlining the structure of the interview, discussing it informally with a few people including the District Technology Coordinator and pilot testing it with a colleague also helped build a more confident relationship between teachers and myself as the interview questions targeted issues that teachers dealt with on a regular basis.

Interview procedure

I explained the ethical and technical aspects of the interview procedure both in the cover letter that accompanied the *SoCQ* during the quantitative phase and in-person before the interviews. A question on *SoCQ* asked for names of those elementary teachers who were agreeable to an interview. I sent an electronic message to each volunteer to set up an interview, and scheduled a meeting according to their availability and the place of their choosing. I recorded the interviews using two digital Olympus recorders simultaneously. I used one as a backup in case the other one fails. I used the DSS Player software and Olympus recorders to transfer voice files recorded using Olympus recorders to a PC for analysis.

I explained the interview procedure once before the interviews started and once after the recording was initiated. I informed all the interviewees of the confidentiality of the interviews before and at the beginning of the recording. I assured the participants that when quoted in the research results, pseudonyms or special codes would replace their actual names. I informed the Interviewees that the purpose of the research was to explore their concerns and perceptions with regard to the integration of ICT in their practice. All participants gave permission to tape record the sessions. I obtained their approval first before the interview and another time when the tape-recorder was on. I carried out all the interviews in respondents' schools as per their choosing. I had a paper copy of the questions available for those respondents who were more visually oriented to be able to refer to if they so desired. I continued the interviews until the point of a mutual understanding between the interviewee and myself was established. The interviews ranged in length from 19 to 62 minutes averaging approximately 40 minutes (Table 5, p. 102). After each interview, I downloaded the recorded interview and saved it on the hard drive and on a disk. I also kept a reflective journal on each respondent and the overall process after each interview was completed.

Data analysis procedure: Coding and categorizing

The aim of the data analysis stage is to categorize and reorganize the qualitative data in order to seek patterns and themes that would help answer the research question (Drever, 1995; Gall et al., 2003; Lofland, Snow, Anderson, & Lofland, 2006; Patton, 2002). Content analysis (Atkins, 1984; Burnard, 1994; Coffey & Atkinson, 1996; Graneheim & Lundman, 2003; Lofland et al.; Patton, 2002; Weber, 1990) was used to analyze the data in this study, and to identify emerging categories of personal responses of elementary educators from

Table 5: **Summary of some features of the interview procedure**

School #	Name/ Gender	Interview Date/ Time	File #	Interview Length	# of pages transcribed (single space)
4	Katherine	May 30, 3:15 pm	DS20009.WMA	0:41:22	10
6	Dale	May 31, 10:50 am	DS20028.WMA	0:54:24	12
12	Sue	June 15, 3:00 pm	DS20042.WMA	0:55:20	13
2	Ron	May 31, 4:15 pm	DS20011.WMA	0:40:17	10
7	Cassie	June 8, 1:00 pm	DS20027.WMA	0:33:26	9
3	Doris	May 28, 4:00 pm	DS20008.WMA	1:01:45	14
14	George	June 5, 3:30 pm	DS20019.WMA	0:35:00	10
6	Paul	June 14, 3:30 pm	DS20029.WMA	0:30:37	9
4	Jim	June 7, 3:00 pm	DS20025.WMA	0:27:15	7
8	Beverly	June 6, 3:20 pm	DS20022.WMA	0:30:42	8
4	Dan	June 19, 3:00 pm	DS20044.WMA	0:18:57	6
4	Kim	June 14, 11:20 am	DS20026.WMA	0:26:19	7
7	Olivia	June 21, 3:00 pm	DS20049.WMA	0:32:58	9
1	Chloe	June 14, 9:15 am	DS20035.WMA	0:47:49	13
13	Jeannette	June 12, 3:45 pm	DS20033.WMA	0:24:58	8
8	Elizabeth	June 26, 3:00 pm	DS20035.WMA	0:43:45	12
4	Sarah	June 11, 3:00 pm	DS20030.WMA	0:37:56	9

the transcripts of the interviews. As Patton describes, overall, "content analysis is used to refer to any qualitative data reduction and sense-making effort that takes a volume of qualitative material and attempts to identify core consistencies and

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Based on my research purpose and questions, the content analysis in my study focused on the manifest content of the text (Graneheim & Lundman, 2003). The manifest content, which is often presented in “categories”, refers to what the text says, and describes the content of the text, which is visible and obvious. However, latent content is expressed as “themes” and refers to what the text is talking about, and involves the interpretation of the underlying meaning of the text. In this descriptive qualitative research design, the manifest content focus allowed me to identify the major categories of data that described the personal responses (views, feelings and concerns, experiences and perceptions) of elementary educators with regard to ICT integration. However, in order to label the categories, some deeper interpretations of data had to occur.

The process of content analysis, usually used to organize and analyze texts such as interview transcripts, diaries, or documents (Gall et al., 2003; Patton, 2002) should start with the selection of a unit of analysis, which might refer to a variety of objects of study ranging from a person, an organization or a community to interviews, diaries, part of the text or every word or phrases in the transcript (Burnard, 1994; Graneheim & Lundman, 2003; Patton, 2002; Weber, 1990). The unit of analysis in this study is *interview texts* of the responses of 17 elementary educators with regard to ICT integration.

Based on the main categories of questions that framed and guided the interviews, I sorted the interview texts into five content areas: (a) views with regard to ICT integration; (b) feelings with regard to ICT integration; (c) concerns with regard to ICT integration; (d) personal experience with ICT integration and (e) perceptions of ICT characteristics. A *content area* refers to parts of the text based on theoretical assumptions from literature, or can be parts of the text that address a specific topic in an interview or observation guide (Graneheim & Lundman). As Coffey & Atkinson (1996) mention "these very general categories promote the reordering of the data in accordance with preliminary ideas or concepts." (p. 35) and the whole process constitutes the first level of coding, which allows the researcher to organize data into meaningful categories.

The reorganization of the text in the process of content analysis may be conducted differently for different questions. I analyzed elementary teachers' interview transcripts as follows: Identifying, Coding, Categorizing, Classifying and Labelling the primary patterns in the data (Atkins, 1984; Burnard, 1994; Patton, 2002; Loftland et al., 2006). In order to make the process of content analysis more manageable, I used HyperRESEARCH (www.researchware.com), a qualitative data analysis software to assist the analysis. This software facilitated data storage, coding, retrieval, comparing and linking as part of the data analysis stage. In the following sections, I explain the step by step process of content analysis that I undertook to analyze the interview transcripts in this study.

Identifying

After transcribing the interviews, I read over all the interview transcripts to obtain a general impression of the personal responses of the elementary educators. I then proceeded to identify the *meaning units* for each content area of individual interviews. Each *meaning unit* refers to a section of the text that might include a collection of words or statements or paragraphs that together contain one item of information or idea, which could be understood irrespective of the text (Burnard, 1994; Gall et al, 2003; Graneheim & Lundman, 2003). Using HyperResearch software, I could select each segment of the text by clicking and dragging the cursor over the passage that I had identified as a *meaning unit*, which was as a result highlighted and ready for tagging.

Coding

Once I identified a meaning unit, I coded it. Overall, the process of coding refers to sorting and condensing the collected data into various analyzable units based on our concepts or frameworks (Coffey & Atkinson, 1996; Loftand et al., 2006, M; Miles & Huberman, 1994). The process actually involves both identifying and tagging or labelling the data, and relating it to the sets of ideas that we have about it. The words or symbols used to tag the meaning units are called *codes*. Based on Miles and Huberman, codes "usually are attached to 'chunks' of varying size-words, phrases, sentences or whole paragraphs, connected or unconnected to a specific setting. They can take the form of a straightforward category label or a more complex one (e.g. metaphor)" (p. 56).

When coding data, I conducted two overlapping sorting and categorizing procedures: initial coding and focused coding (Loftand et al., 2006). During the initial or open coding, I inspected the interview transcripts line by line and organized and condensed data based on perspectives of each respondent. The focused coding helped me define and refine the initial coding and make the codes more elaborate and specific. This process would link larger segments of data together and eliminate the less useful descriptive and analytical codes leading to a dictionary of meaningful codes, which I then used to classify the responses of participants. As recommended by Loftland et al., I initially engaged in an extensive and pervasive coding as well as multiple coding of single items when appropriate. My goal for this content analysis was to simplify and reduce data to simple and manageable analytic categories (Coffey & Atkinson, 1996). The emerging codes in this study and their numbers are tabulated throughout chapter 5 where the qualitative findings are presented and discussed.

Based on the principles of content analysis discussed in the related literature (Atkins, 1984; Burnard, 1994; Coffey & Atkinson, 1996; Drever, 1995; Gall et al., 2003; Graneheim & Lundman, 2003; Miles & Huberman, 1994;

Lofland et al., 2006; Patton, 2002; Weber, 1990), I followed various aspects of Atkins (1984), Burnard (1994) and Graneheim and Lundman's (2004) models to proceed with the coding task. The following sections describe the steps that I undertook to complete the coding of the interview transcripts.

I took each content area in the interview texts in turn. For each question, I read the corresponding response from the transcript. As already explained in the previous sections, using HyperResearch assistive software, I coded the texts. Every time that I highlighted and coded a new meaning unit, the new code was automatically added to the HyperResearch Master Code List. Having all these codes available, I read and coded each subsequent response using the Master Code list that displayed all the existing codes. If a match couldn't be found, I added new codes to tag emerging and new meaning units. In this way, I developed a complete set of codes that I used to tag the corresponding statements.

It should be mentioned that I obtained the final assigned code as a result of condensing and abstracting the corresponding meaning unit (Graneheim, & Lundman's, 2004). The *condensation* "refers to a process of shortening while still preserving the core." (p. 106) and *abstraction* refers to "descriptions and interpretations on a higher logical level." (p. 106). Codes, categories and themes are examples of different levels of the process of abstraction. Table 6 (p.108) displays an example of how I condensed and coded the meaning units of interviews. HyperResearch has different options that allow for the editing and renaming of codes. Therefore, during the focused coding that followed the initial open coding (Loftand et al., 2006), it was possible to convert the condensed meaning units to the final codes.

Table 6: Examples of meaning units, condensed meaning units and codes (adapted from Graneheim, & Lundman's, 2004)

Meaning Unit	Condensed meaning unit	code
I believe the technology and information on the computers has to be used also with other resources, library books, encyclopaedias, there has to be a balance, if you just do technology and computer and the kids don't know how to research using other places of information so there has to be a balance there.	balanced use of ICT and other resources, library books, encyclopaedias	different resources
So there are two things, there is excitement there and the vision and yes I can see where we can go with it but then the reality comes in, as oh, I don't have enough time or materials or my own knowledge isn't where I need to so I have got two conflicting sort of feelings, frustration and excitement, worrying away which I suppose it's in anything that happens when you learn.	mixed feelings of excitement of what can be done and frustration due to lack of resources and knowledge concerning the integration of ICT	mixed feelings

Overall, the initial and focused coding and the process of condensation and abstraction of the meaning units during the coding task required reading and re-reading of the interview transcripts, and as a result led to different levels of my involvement with the data. Thus, the process of coding is not a mechanistic assignment where the researcher only fragments the text into different segments. As Coffey and Atkins explain, coding "reflects a series of readings and re-

readings of the data, in which the details of the interview and our own emergent concerns interact." (p. 44). I coded all the interview questions following the previously described steps and principles of qualitative content analysis.

To facilitate the analysis process and in order to have a better understanding of the answers discussed in the interviews, I tabulated all the assigned codes from each content area together, and I listed the number of corresponding statements to each code in each table. As seen in Table 7 (p. 110), which presents a sample of such tables, some meaning units have been double coded. For example, when a respondent discussed the value of ICT integration in schools, she first indicated if she agreed or disagreed that ICT was worthwhile, and then she mentioned reasons why she thought that ICT was or was not worthwhile. Therefore, the double code indicated both the respondent straightforward yes or no reply and those meaning units that reflected the reasons for their approval of disapproval.

Categorizing

Once I identified and tagged the meaning units, I started looking for patterns of similarities and differences in the responses offered by elementary educators in their interviews. I was able to regroup those contents that shared a commonality into their corresponding categories (Atkins, 1984; Burnard, 1994; Graneheim, & Lundman, 2004). Obtaining an exhaustive category system is one of the major characteristics and objectives of content analysis process, which helps consolidate all the findings and meaning units from the text. Atkins recommends not to exceed 10 to 12 discrete categories because a larger number would lead to few examples in each category and a small number would

Table 7: Sample of a table concerning the participants' views showing codes, code definitions and number of statements made for each code. (This is only a portion of the view table.)

Code	Number of Statements	Code Definition
ICT underutilization	3	This code marks passages in which the respondent indicates that ICT is not used to full potential in his/her school.
children engaged with ICT	7	This code marks passages in which the respondent indicates that he/she believes that today's children are more engaged with and relate to ICT.
changing views	2	This code marks passages in which the respondent indicates that his/her view about ICT integration has changed in time for different reasons.
changing schools	1	This code marks passages in which the respondent indicates that schools are starting to change as a result of technology diffusion.
ICT worth/ ICT and learning	5	This code marks passages in which the respondent indicates a range of views on reasons for worth of ICT or lack of it in schools.
ICT worth/ changing world	4	See definition above/This code marks passages in which the respondent indicates that the world around us is changing.

reflect an insufficient analysis of the data. A category can include a number of sub-categories. Using tables such as Table 7 above and by constantly referring back to the interview transcripts to recontextualize the meaning units, I regrouped the codes for each content area into different categories, which I then labelled based on their content and the messages they conveyed. I used HyperResearch to retrieve codes and to check the corresponding meaning units in the texts.

Analysis of the DIQ open-ended statements

The final question of the *DIQ* included a section for educators to write their concerns with regard to ICT integration in elementary schools in their own terms. I analyzed respondents' statements qualitatively to understand their concerns, and to support the major research question. I followed the same principles of coding and categorizing to regroup the major ideas emerging from these statements.

Reliability

Reliability refers to the extent to which different readers and researchers arrive at similar meanings and results if they use the same standard methods and procedures as the researcher, leading to consistent research findings (Gall et al., 2005, Kvale, 1996). As a result, all the aspects of the research study such as making decisions about the focus of the study, selection of context, participants, approaches to data gathering such as procedures for interviews and transcription will have direct impact on the reliability of the analysis.

In the context of this study, I made certain to carefully report all aspects of the qualitative phase to my committee, and detail the procedures I followed to collect and analyze data in this dissertation. Interviewees had various demographic backgrounds, which contributed to a richer variation of the phenomena under study. Since, I was the only interviewer, I minimized the inter-interviewer inconsistency in administering the questions. All the interviews were tape-recorded, which provided a check on self-consistency. I personally did the transcription verbatim and increased the level of consistency and familiarity with the content of the interviews. The open-ended nature of questions (Kvale, 1996) increased the reliability of the analysis as the interviewees had the opportunity to express themselves as freely as possible. I also followed the code-recode procedure to strengthen the reliability of my content analysis during which, I coded part of the data manually and then at a later date recoded using the HyperResearch software, and compared results (Weber, 1990). I should note that I e-mailed all the interview transcripts to the participants to ensure the consistency of my understanding and the participants' accuracy of their statements, therefore strengthening the credibility of my transcripts.

Validity

To check the accuracy of findings of a qualitative research study, Creswell (2003) recommends performing a validity check by identifying and discussing one or more strategies. In this research study, I implemented the following strategies to ensure internal validity in the research process:

-Triangulation: I achieved triangulation through the combined use of surveys and interviews. The *DIQ* included an open-ended statement adding additional insight to the context of the study. Therefore, I had four sources of data for this research: *SoCQ*, demographic data, open-ended statements and interviews. I also used multiple data sources such as teachers at different Stages of Concern from 14 different schools and a principal as confirmatory evidence for the validity of the qualitative research findings.

-Peer debriefing: I asked one interviewee to go through the coding procedure of his interview and comment on any part that did not reflect his views, and I had a discussion with him afterwards. I also asked a Doctoral graduate student to review a sample of answers and code the meaning units by referring to the dictionary of codes provided, to ensure that another person would also link the corresponding codes to the same meaning units.

-Researcher self-reflection: Throughout the research, I kept a reflective journal to focus on my biases and assumptions concerning my research, and to review and reflect on the procedures of my research.

Summary and conclusions

In this chapter, I detailed methods of data collection and analysis that I used for this sequential explanatory mixed method research design through which, I attempted to analyze the concerns of elementary educators with regard to the diffusion of ICT in schools. The mixed methods research design consisted of two phases. In phase one, the quantitative phase, I administered a two-part survey comprised of *The Stages of Concern Questionnaire and Demographic Information Questionnaire* to a purposive sample of 14 elementary schools in district X, in February 2007. I analyzed the collected data in March 2007. I identified the interview volunteers, and interviewed a purposive stratified sample of elementary educators in May/June 2007. I then proceeded with the analysis of my results. Overall, the mixed methods research design helps researchers to bring breadth and depth into their study.

In the following chapters, I analyze the findings of each phase of this study to answer the corresponding research questions, and I then integrate and consolidate these findings to answer the major research question.

CHAPTER FOUR
ANALYSIS OF FINDINGS FROM PHASE ONE: SURVEY ANALYSIS

Go as far as you can see, and when you get there you'll see further.
-Iranian proverb

I used the data from the first phase of this study to investigate the overall research question regarding the concerns of elementary educators about the integration of ICT in their practice. More specifically, the first phase of this research sought to answer the following questions:

1. *What are the proportions of concerns that are self, task, and impact concerns among elementary educators with regard to the integration of Information and Communication Technology in Curriculum?*
2. *What are the relationships between elementary educators' current Stages of Concern and their demographic background?*

According to George et al. (2006), by correlating the demographic data with the data obtained from the *SoCQ*, one can improve the interpretations of concerns data. In the following sections, I present descriptive statistics of the demographic data that I collected from the 63 teachers in this study. I will then interpret the *SoCQ* data and proceed with the statistical tests of association between demographic data and Stages of Concern of the respondents.

Sample characteristics

The sample for the first phase of this study consisted of K-5 school administrators and teachers in District X who voluntarily completed the survey within the timeframe of one month. From the 230 elementary educators in the sample, 63 educators completed and returned the questionnaires in this phase, which represented a response rate of 27.4% for the mailed survey.

In a presentation entitled, *Addressing the Growing Problem of Survey Nonresponse* (http://www.ssri.psu.edu/survey/Nonresponse1.ppt#1), David R. Johnson, the director of Penn State Survey Centre indicates that the expected response rate for mail surveys of special populations ranges from 20% to 80%. He suggests a number of explanations for the increases in nonresponse rates such as time constraints ("too busy"), lessened sense of civic responsibility or sense of reciprocity, too many survey requests, and concerns about safety, fraud and misrepresentations. In this study, based on my own experience as a teacher as well as statements made by many principals during my preliminary meetings, the time constraints and other daily demands on teachers appear to be a major factor impacting the response rate.

Nevertheless, the sample of 63 educators was still reasonably large, and sufficiently diverse to provide some important findings for informed decision making with regard to the concerns of these educators with ICT integration in their practice. Although I did not attempt to generalize the findings of this research to the general population of elementary educators in District X, I did compare elementary educators' demographic variables to district averages based on 2006-2007 BC District Data (http://www.bced.gov.bc.ca/reporting/enrol/teach.php). It should be mentioned that the district averages were provided for the entire District K-12 educators' population, and I only had access to such variables as age, gender and years of experience. As seen in Table 8 below, the average age and years of experience of the study sample are very close to the District X averages for these variables, which would add to the value of findings from this research.

Table 8: Study sample demographic variables averages versus District X averages

	Study Sample Average/% (K-5)	District X Average/% (K-12)
Gender	Male: 16.7%	Male: 34.1%
	Female: 83.3%	Female: 65.9%
Age	44	43
Years of experience	15	12

As for the gender proportion, both populations presented a larger proportion of female educators, however it seemed that there was an over-representation of female educators in the study sample in comparison to the district gender proportions. Based on the statistics published in the *Vancouver School Board Employment Equity Council Newsletter* (2001), only 331 of 2166 or 15% of permanent elementary school teachers in Vancouver are male, which might explain the high percentage of female teachers in the sample study. Furthermore, the District proportion of male and female educators corresponds to the entire K-12 population and is not indicative of only the elementary school population.

From the 63 educators responding to the survey, 2 reported being principals of elementary schools with some teaching assignments, and 61 were elementary school teachers with a variety of teaching assignments at different levels. Table 9 (p. 118) details the demographic characteristics of the elementary educators who participated in the first phase of this study. The percentages in parentheses correspond to the participants who responded to each question.

As part of the Demographic Survey, elementary educators reported a variety of technology related activities that they had taken in and out of the district over the previous two years. I grouped these activities in Table 10 (p. 120) under three major categories: Professional development activities, Technology focus groups/committees, and Degrees/courses.

The 63 teachers in the sample also reported the number of computer-based ICT skills that they applied in their teaching and for personal use (Table 11, p. 121). Based on the results in Table 11, the three ICT skills most often used by respondents in both their teaching and personal use were Research/Internet (95%, 97%), Writing/Word Processing (94%, 95%) and E-mail (75%, 97%). The skills least used in teaching were Creating a Network (3%), Programming (6%), Online shopping (13%) and working with a Database (14%).

Open-ended Statements

17.5% (11 teachers) of all respondents made open-ended statements to the final question of *DIQ*: *Any additional comments and/or concerns regarding computer technology in elementary schools?* I have presented the emerging categories of concern in Table 12 (p. 122). The quotations exemplify the

Table 9: Demographics of phase one respondents

Phase One Respondents		
Gender 60 responses (95.2% of participants responded.)	**Male**	10 (16.7%)
	Female	50 (83.3%)
Age 62 responses (98.4 %)	**20-29 years**	4 (6.4%)
	30-39 years	16 (25.8%)
	40-49 years	21 (33.9%)
	50 years or plus	21 (33.9%)
Educational level 57 responses (90.5%)	**Bachelor**	24 (42.1%)
	Pb+15	21 (36.8%)
	Masters	12 (21.1%)
	Doctorate	0 (0%)
Years of teaching experience 63 responses (100%)	**0-5**	9 (14.3%)
	6-10	15 (23.8%)
	11-15	7 (11.1%)
	16-20	14 (22.2%)
	21-25	9 (14.3%)
	Over 25	9 (14.3%)
Teaching assignment 57 responses (90.5%)	**Kindergarten**	6 (10.5%)
	1-3	21 (36.8%)
	4-5	16 (28.1%)
	Library	5 (8.8%)
	Student services	8 (14%)
	Fine arts	1 (1.8%)
Number of classroom computers 62 responses (98.4%)	**N/A**	2 (3.2%)
	1 computer	33 (53.3 %)
	2 computers	21 (33.9%)
	3 computers	2 (3.2 %)
	4-5 computers	1 (1.6%)
	8 computers	1 (1.6%)
	30 computers	2 (3.2%)
ICT learning team membership 63 responses (100%)	**members**	37 (59%)
	non-members	26 (41%)

Number of classroom internet 59 responses (93.7%)	**N/A**	2 (3.4 %)
	1 computer	39 (66.1 %)
	2 computers	14 (23.7%)
	3 computers	0 (0%)
	4-5 computers	2 (3.4%)
	8 computers	0 (0%)
	30 computers	2 (3.4%)
Home access 63 responses (100%)	**to computers** **to internet**	63 (100%) 60 (95%)
Computer expertise perception 61 responses (96.8%)	**Nonuser**	0 (0%)
	Novice	16 (26.2%)
	Intermediate	36 (59%)
	Experienced	9 (14.8%)
Length of computer use in teaching 63 responses (100%)	**None**	2 (3.2%)
	Less than 1 year	3 (4.8%)
	1-2 years	6 (9.5%)
	2-3 years	5 (7.9%)
	3-5 years	11 (17.5%)
	More than 5 years	36 (57.1 %)
Hours of Computer Technology Training/Workshops 63 responses (100%)	**None**	9 (14.3%)
	1-9 hours	35 (55.6%)
	10-19 hours	9 (14.3%)
	20-39 hours	3 (4.7%)
	40 hours or more	7 (11.1%)
Number of computer-based ICT skills in teaching 63 responses (100%)	**0-3**	10 (15.9%)
	4-7	28 (44.4%)
	8-11	17 (27%)
	12-15	7 (11.1%)
	16-19	1 (16%)
Number of computer-based ICT skills for personal use 63 responses (100%)	**0-3**	6 (9.5%)
	4-7	16 (25.4%)
	8-11	23 (36.5%)
	12-15	12 (19.1%)
	16-19	6 (9.5%)

Table 10: Type of Technology activities undertaken by respondents.

Professional Development Activities	<u>Information and Communication Learning Teams: Focus of Inquiry</u>: • Implementing SMARTBoards • Learning to use Kidspiration to improve student literacy skills • Learning to use Email, PowerPoint, Kidpix, SharePoint, Comic Life, Word to improve student learning • Using Kidspiration to facilitate the writing process • Implementing problem based learning: Kidspiration, Kidpix, PowerPoint, Web Pages, importing & exporting pictures, Videos & Music • Implementing reading strategies that foster reading comprehension • Integrating technology into the mathematics elementary curriculum (Numeracy and problem solving) • Connecting reading & writing through technology <u>Professional Development workshops</u>: • Kidpix, Kidspiration, SmartBoard, Sharepoint, Tools for Schools, TAP Project, Dreamweaver, Garage Band, Photostory, ProShow Gold, Power Point, iMovie, Photoshop, Report cards workshop • Elementary, Digital Scrapbooking, NASA workshop • School-based Professional Development workshops <u>Conferences</u>: • CUEBC, PITA, District Technology Conference, SET BC, Art Teachers Conference
Technology Focus Groups/ Committees	• Elementary Computer Use Focus Group • Desktop Experience Focus Group • District committees focusing on IEP templates and Report Card templates • District Educational Technology Committee
Courses/ Degrees	• TLITE courses or diploma • Master of Educational Technology • UBC Courses in Technology • SFU Education course: Design for teaching computers

Table 11: Percentage of teachers with different Computer-based ICT skills

Item	ICT Skill	In Teaching		Personal Use	
		n	%	n	%
1	Organizing Files/folders on hard drive/File management	44	70	54	86
2	Writing/Word processing	59	94	60	95
3	Calculating/Spreadsheet	18	29	29	46
4	Database	9	14	18	29
5	Skills mastery/Drill and practice	37	59	8	13
6	Research/Internet	60	95	61	97
7	Community interaction/Online discussions	14	22	26	
8	E-mail	47	75	61	97
9	Graphics	35	56	33	52
10	Programming	4	6	5	8
11	Presentation	26	41	16	25
12	Creating a Webpage	10	16	11	17
13	Playing digital media (video/audio)	16	25	36	57
14	Editing media (video/audio)	8	13	22	35
15	Troubleshooting computer problems	22	35	32	51
16	Creating a Network	2	3	5	8
17	Games/Entertainment	24	38	34	54
18	Special Purpose/Tax, Finance, etc	0	0	32	51
19	Online shopping	8	13	43	68

emerging ideas highlighted in each category. I have also displayed in Table 12 below, the number of educators with common concerns. Overall, I could group the emerging concerns into five major categories: Concerns related to time constraint, concerns related to proper technology equipment, concerns related to lack of information and/or proper technology training, concerns related to ICT literacy and integration, and concerns related to onsite technology specialists. These findings are discussed in more detail in relation with findings from phase two of this study in the succeeding chapters.

Table 12: Elementary educators' concerns with regard to ICT integration based on open-ended statements

Category	Statements
Concerns related to time constraint (*4 teachers*)	**T10:** "*I am finding time constraints to be the biggest factor for not using ICT... Our meeting for learning team is tomorrow and no one has had the time to complete their goal. So right now, I'm frustrated, and feel that the amount I have to learn is so large. I am overwhelmed with where to start + what's important to focus on...I guess we're trying to do 2 things at once, learn about technology, educate ourselves and try to use it in the classroom...I'm trying to implement a new reading program and learn a new math program too. I feel that I'm not doing justice to ICT. Maybe It's all about baby steps, one step a time."* **T50:** "*I am also finding having to read emails just one more thing of the something I forget to do! This is critical when a parent emails me about something regarding their child. However, I do like emails over numerous phone calls.*" **T52:** "*Teachers need time to learn to use the technology themselves first!!*" **T60:** "*Not many teachers are involved. No time/interest.*"
Concerns related to proper technology equipment (*3 teachers*)	**T10:** "*...equipment that works-ours are really old + breakdown or don't run the latest stuff. I'd like to do more but I'm busy with teaching basics and get frustrated when the computers are so slow and breakdown whenever I do use them."* **T40:** "*Many days the computers aren't working so we won't have 20 working in the lab...How do I use the 2 machines in the classroom effectively with 30 students?"* **T59:** "*Huge concern re BCeSis+related large scale adoption of systems that Do Not Reflect best teaching practice, threaten our autonomy, create frequent system crashes that paralyze schools, inability to get information from the system + Wastes PRECIOUS TIME!*"

Concerns related to ICT literacy/ integration *(2 teachers)*	**T18:** *"At my level, I find that early literacy is necessary before I introduce computers to children. I do teach basic computer introduction. This basically means that I teach them rudimentary slices such as login, saving, retrieving not much more."* **T40:** *"Students keyboarding skills are weak-should we insist on proper keyboarding (fingering)."*
Concerns related to lack of information and/or appropriate technology training (*4 teachers)*	**T36:** *"We had several members at all different ability levels. I was definitely the least able, by a long way! The topics we discussed + worked on were far beyond my ability level and there was no time for individual help. Another teacher quit the program and one other said she was as stressed as I was. I found it very stressful and not too helpful for me."* **T40:** *"It takes so long to find appropriate sites on the internet which are useful to Gr. 5 curriculum that I get frustrated looking....The students know more than I do and yet I'm reluctant to let them "go: in the computer room."* **T48:** *"My concerns are that we have seen little district support for: 1) me as side contact with no official training and very little knowledge of PC's, 2) classroom teachers support for teaching computers themselves. We have only had maybe 2 workshops last year and although we eagerly applied for an ICT, have not seen anymore yet and it is mid Feb!"* **T50:** *"I am concerned about the lack of information/ training available for the implementation of report cards. The school district has expectations that all people have experience with computers...doing (writing) report cards is stressful enough without the added stress that unknown technology (or how to use it) adds."*
Concerns related to onsite technology specialists (*4 teachers)*	**T10:** *"The staff are not all trained in using computers and we have no one to help us on a regular basis."* **T43:** *"My concern is we won't have a person on hand to help with technology glitches that we run into, no we don't have a real cpu expert as it stands now."* **T46:** *"I believe that there needs to be a computer teacher who works collaboratively with classroom teachers for implementation to be successful. Much the same way that libraries should be staffed to work in partnerships with teachers to do collaborative units."* **T52:** *"Any of us who will be more responsible for inservicing staff formally/informally our own staff, asked to set up equipment etc etc should get extra prep time +receive release time to attend course work/workshops."*

Research question 1

1. *What are the proportions of concerns that are self, task, and impact concerns among elementary educators with regard to the integration of Information and Communication Technology in Curriculum?*

As explained in chapter two, I used *The manual for use* of *Stages of Concern Questionnaire* (George et al., 2006), the SOCQ 075 Scoring Program

(SAS file, George, 2006) and the Statistical Analysis Software (SAS, 2003) to calculate the quantitative data obtained from elementary educators. Table 13 below represents the group statistics for the total raw scores (0-6) provided by *SoCQ*.

Table 13: SoC Group Statistics

Stages of Concern	**0**	**1**	**2**	**3**	**4**	**5**	**6**
MEANS	18	20	19	19	19	18	15
STDS	6.5	6.9	8.8	7.1	7.1	7.9	6.7

Based on *The manual for use* of *Stages of Concern Questionnaire* (George et al., 2006), the data obtained through the use of *SoCQ* can be interpreted at three different levels of detail and abstraction: *Peak Stage Score Interpretation*, *First and Second High Stage Score Interpretation* and *Profile Interpretation*. In what follows, I present these three procedures to examine the results. Overall, in order to achieve the best interpretation of *SoCQ* data, George et al recommend referring to the paragraph definitions for each SoC (Table 1, p. 7), establishing a holistic perspective, looking at high and low stage scores, and looking at individual item responses. Based on these recommendations and by including individual demographic information, I wrote a hypothetical profile for each individual, an example of which is presented below:

> Teacher #6 (ER35) has a dual assignment which is equally distributed between teaching Grade 2/3 and Computers at elementary level. He perceives himself as an experienced computer user and has received 10-19 hours of Computer training/workshop in the past two years. Based on his demographic information, he has been involved with a number of technology related activities such as being a participant and facilitator of

an ICT learning team, a member of an Elementary Technology Focus Group, X Teacher Association Desktop Experience Focus Group and a presenter at the CUEBC Conference. He has been a teacher for the last 8 years. This teacher demonstrates higher levels of concern on Stages, 3, 4 and 5, with stage 3 being the highest peak concerns, and lower levels of concerns on Stages 0, 1 and 2. The low scores on Stages 0, 1 and 2 indicate that this teacher is knowledgeable about and comfortable with the innovation. The high Stage 3, 4 and 5 scores reflect this teacher's management and impact concerns about the integration of ICT in curriculum. Overall, the concerns profile of this teacher indicates that he is an involved user of the innovation who is concerned about the broad-range impact of integrating ICT in curriculum. The demographic information confirms this teacher's SoC.

Peak Stage Scores Interpretation

The *Peak Stage Score Interpretation,* which is the simplest form of *SoCQ* data interpretation, identifies the highest or peak stage score of concern for each respondent. The peak stage score can be easily identified once individual Stages of Concern percentile scores are tabulated. This is indicative of one of the seven stages where a respondent is at his most intense level of concerns regarding an innovation. It is also recommended to identify any other stage score, which is within one or two percentile points of the highest score. These close stage scores represent essentially a tie for the respondent's most intense SoC. The peak score is then interpreted based on the *Stages of Concern About an Innovation definitions* (Table 1, p. 7).

Based on the results obtained from *SoCQ*, the highest or peak stages of concern for most elementary educators in this study happened to be Stage 0 and 3 (Table 14, p. 126). These results indicate that many of these individuals (52.4%) might not be engaged with integrating ICT in curriculum and might be busy with other tasks and initiatives (Stage 0-Unconcerned). Others (14.3%) had a general awareness of the innovation and were interested in learning more about ICT integration (Stage 1-Informational). A smaller number of educators (4.8 %) exhibited ego-oriented concerns and/or uncertainty about ICT integration on Stage 2 (Personal), while another group of educators (22.2%) was most concerned about the time and/or management the innovation required (Stage 3-Management). Only 6.3% of teachers were at a higher impact level of concern, Stage 5 (Collaboration). These teachers would like to coordinate their efforts with other colleagues in order to maximize the effect of ICT integration in curriculum. No respondents reported on Stages 4 (Consequences) and 6 (Refocusing).

Table 14: Frequency of highest concern stage for the individual respondents

	Highest Stage of Concern							
	0	**1**	**2**	**3**	**4**	**5**	**6**	**Total**
Number of Teachers	33	9	3	14	0	4	0	**63**
Percent of Teachers	52.4	14.3	4.8	22.2	0	6.3	0	**100**

Overall, individual concern analysis indicated that 45 of the 63 respondents (71.4 %) had intensity peaks at the self-concern stages (unconcerned, informational, and personal); 14 respondents (22.2%) reported the task concern (management); and 4 respondents (6.4%) had intensity peaks at impact concern stage (collaboration). In general, educators with self-type concerns are non-users or low users who are more concerned about gaining information about the use of ICT in teaching, or about how change will affect them personally. As they become more involved with ICT and begin to use it in their teaching, they develop more intense concerns in the area of Management (task concerns). As educators become more experienced, knowledgeable and skilled with the use of ICT in their teaching, their lower and early concerns decrease in intensity, and they develop higher impact concerns, shifting toward Consequence, Collaboration, and Refocusing stages where they are mainly preoccupied with their students' learning (Hall et al., 1979; Hord & Hall, 1987). Therefore, teachers who fall in the four late Stages of Concern (management, consequence, collaboration, and refocusing) and report management and impact-type concerns are users who are becoming increasingly involved with the use of the innovation. However, teachers who fall on the first and early Stages of Concern (unconcerned, informational and personal) report self-type concerns, and are considered as non-users who have not yet accepted or become fully involved with the educational innovation. The analysis of peak concerns of individuals in the sample revealed that the majority of respondents (71.4%) had not yet successfully integrated educational technology in their teaching.

First and Second Highest Stage Scores Interpretation

The *First and Second High Stage Score Interpretation* (George et al., 2006), examines both the highest and second highest stage scores, and therefore provides researchers with a more detailed interpretation of the *SoCQ* data. The most likely scenario occurs when the second highest score is adjacent to the first highest score, however, different combinations are plausible and their interpretation will lead to a better understanding of the dynamic of the

Stages of Concern for individual respondents. Once I identified these scores for each respondent, I developed a matrix that cross-tabulated each individual's highest and second highest SoC (Table 15, below). In order to identify the most frequent second highest SoC, one of the seven highest stages from the left-hand column is selected and then the information provided is read across. This cross-tabulation helps understand how the individuals are distributed on their second highest stage.

In order to establish patterns of concerns, once I identified the first highest and second highest Stages of Concern, I regrouped them based on the type of concern (self, task, impact) and placed them in a 3 X 3 matrix with nine cells of self-self concerns, self-task concerns, self-impact concerns, task-self concerns, task-task concerns, task-impact concerns, impact-self concerns, impact-task concerns, and impact-impact concerns (Table 15, below).

Table 15: Percent distribution of second highest Stage of Concern in relation to first highest Stage of Concern

Highest Stage of Concern	**Second Highest Stage of Concern**								
	0	**1**	**2**	**3**	**4**	**5**	**6**	**Row %**	**Row #**
0 Unconcerned	0	36.4	33.3	27.3	0	3	0	**52.4**	**33**
1 Informational	22.2	0	55.6	11.1	0	11.1	0	**14.3**	**9**
2 Personal	0	0	0	66.7	0	33.3	0	**4.8**	**3**
3 Management	21.5	42.9	14.3	0	7.1	7.1	7.1	**22.2**	**14**
4 Consequence	0	0	0	0	0	0	0	**0**	**0**
5 Collaboration	50	0	50	0	0	0	0	**6.3**	**4**
6 Refocusing	0	0	0	0	0	0	0	**0**	**0**
								Total	**63**

I classified each educator's profile by his first and second concern, and included their number in each cell. As evident from Table 16 below, two patterns of concern could be distinguished:

- self-concern pattern representing educators with both first and second peaks at the self-concern stages
- mixed concern pattern representing teachers with mixed concerns of two stages (self-task, self-impact, task-self, task-impact and impact-self).

As shown in Table 16 below, of the 63 educators in the sample, 29 (46%) represented the self-concern pattern and 34 (54%) experienced the mixed-concern pattern. Those educators who were mixed concern users had their first and second peak concern at either impact (1^{st} = 4 and 2^{nd} = 3) or task (1^{st} = 9 and 2^{nd} = 15) levels and exhibited either self-oriented or task-oriented concerns. These self and task oriented concerns need to be addressed and resolved in order for these educators to move to the impact-concern user level.

Table 16: The first highest concern in relation to the second highest concern

First highest concern	Second highest concern				
	Self	Task	Impact	Total	Percentage
Self	29	15	3	47	74.6
Task	9	0	3	12	19.1
Impact	4	0	0	4	6.3
				63	100

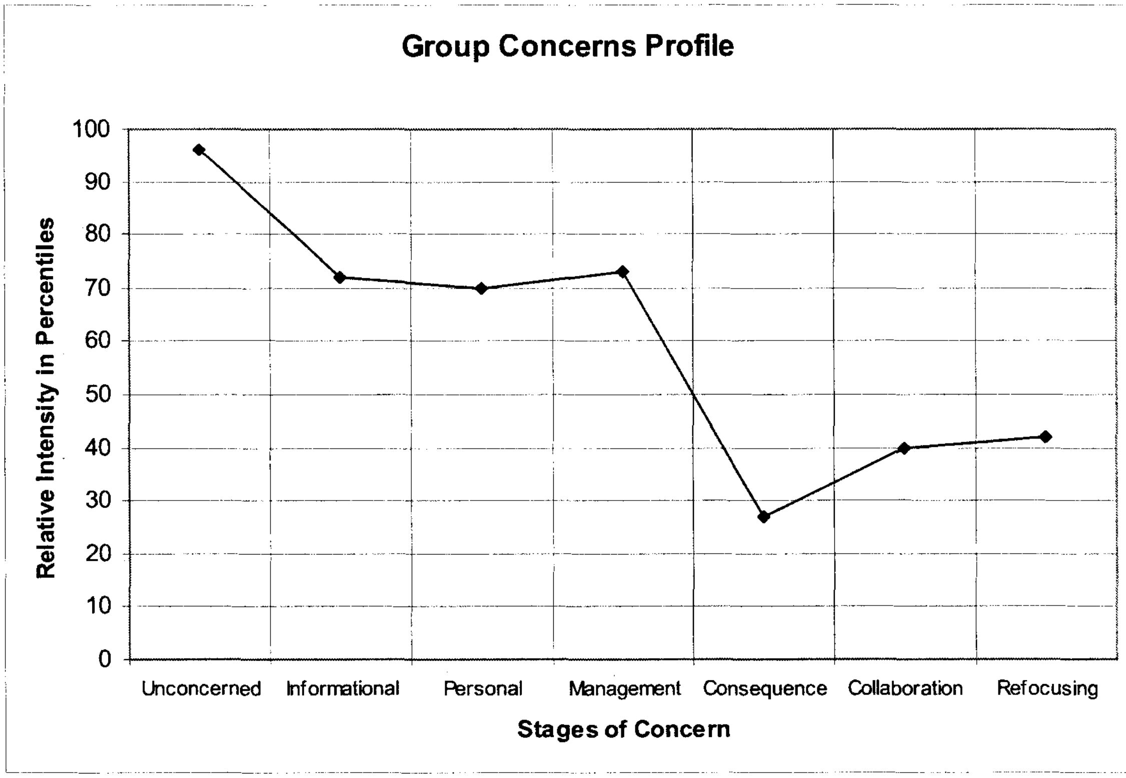
Profile Scores Interpretation

Profile analyses provides the most sensitive and detailed interpretation and assessment of the Stages of Concern of respondents regarding an innovation both at individual and group data levels (George et al., 2006), and provides a very rich clinical picture of the dynamic of the respondents' Stages of Concern about this innovation. This type of interpretation gives researchers the opportunity to look at high and low Stages of Concern and examine their interrelationships. As explained by George et al., the Stages of Concern of individuals in response to an innovation is developmental in nature and moves through defined stages, usually beginning from intense concerns at lower or early stages and shifting to higher or later Stages of Concern.

In the case of an appropriate and well supported innovation, a respondent's concern profile moves like a wave from left to right as he or she starts with most intense concern levels at Stages 0, 1 and 2 and shifts towards Stages 3 and later 4, 5 and 6. The concerns profile interpretation in this study attempted to determine where elementary educators were in this developmental sequence in response to ICT integration in curriculum, at the time of the *SoCQ* administration.

The Group Profile (Figure 3, p. 131) summarizes and displays the results discussed in previous sections in graphical format and provides a general overview of the concerns of the 63 teachers who participated in this study. As shown in Figure 3, it can be observed that the profile exhibited a range of higher scores on self and task stages from Stage 0 (Unconcerned) to Stage 3 (Management) and lower scores on impact Stages 4 (Consequence), 5

Figure 3: Concerns group profile



(Collaboration) and 6 (refocusing). The highest peak was Stage 0 (Unconcerned) and the second highest Stage 3 (Management). Stage 1 (Informational) was slightly higher than Stage 2 (Personal). Overall, based on the manual of the *SoCQ* data interpretation (Geroge et al., 2006), this concerns profile suggested that the population of educators in the sample under study was not overly concerned and/or not fully engaged with integrating ICT in curriculum (High Stage 0) at the time of the survey, but they were proactive about it (Stage 1 higher than Stage 2). Although anxious about the personal outcomes of the innovation (High Stage 2), they were interested and concerned about learning more about the logistics, time and management that it implied (High Stage 1 and

3). If ICT integration is considered worthwhile by elementary educators in this study and if adequate support is provided for its implementation, this concerns profile might follow its natural development and move like a wave from left to right. However, if Informational, Personal and Management concerns remain intense, teachers might be inclined to use the innovation less or even discontinue its use in order to reduce their high level of concern (Hall et al., 1978).

Based on individual analysis of each respondent's profile, a majority of these educators mostly seemed to be busy with other innovations, activities and responsibilities that prevented them from fully concentrating on the task of integrating ICT in curriculum. A group of these educators had developed concerns about management issues related to logistics, structure and function of the innovation. Overall, based on the results of the survey analysis (Table 14, p. 126), 71.4% of respondents in the teachers' sample had Self-type concerns regarding ICT integration in curriculum, 22.2% exhibited Task-type concerns and 6.3% demonstrated Impact-type concerns. It is obvious from this group profile that staff and professional development personnel should address the personal concerns of these educators in order for them to move to the desirable higher impact concerns where educators' focus is purely on using ICT to reinforce students' learning, to collaborate with others to maximize learning, and to explore and refine ways ICT can be used in teaching.

The profile analyses at the individual level gave more insight into the assessment of the Stages of Concern of respondents regarding an innovation. According to George et al. (2006), there are typical *SoCQ* profiles such as the

Unconcerned Innovation Users, *Typical Nonuser SoCQ Profile*, *Typical Single-Peak User Profiles*, *Typical Multiple-Peak User Profiles*. Each profile is determined based on the relative positions of different corresponding Stages of Concern. Once I analyzed the concern profiles for individual participants in the survey, I regrouped them based on their profiles. I then summarized the interpretation results of the concerns profiles of the 63 educators in the sample in Table 17 below.

Table 17: Statistics of the Stages of Concern About ICT Integration in Curriculum

<table>
<tr><td rowspan="3">IMPACT</td><td rowspan="3">Successful Users</td><td colspan="2">Refocusing</td><td>0 (0%)</td></tr>
<tr><td colspan="2">Collaboration</td><td>4 educators (6.4%)</td></tr>
<tr><td colspan="2">Consequence</td><td>0 educator (0%)</td></tr>
<tr><td>TASK</td><td>Management Explorers</td><td colspan="2">Management</td><td>14 educators (22.2%)</td></tr>
<tr><td rowspan="4">SELF</td><td rowspan="4">Nonusers or Low Users</td><td rowspan="3">Typical Nonusers</td><td>Personal</td><td>3 educators (4.8%)</td></tr>
<tr><td>Informational</td><td>9 educators (14.3%)</td></tr>
<tr><td>Unconcerned</td><td>27 educators (42.8%)</td></tr>
<tr><td colspan="2">Unconcerned Innovation Users</td><td>6 teachers (9.5%)</td></tr>
</table>

As shown in Table 17, in the Self-type category (71.4%), 52.3% of elementary educators were on Stage 0 (Unconcerned), 14.3% on Stage 1 (Informational) and 4.8% on Stage 2 (Personal). From 52.3% of teachers who were on Stage 0, 9.5% were *Unconcerned Innovation Users* who lacked interest and/or time to become involved with ICT integration in curriculum. The remaining teachers fell in the category of *Typical Nonusers* who were not fully engaged with the innovation because of other interests and/or commitments but might have some general awareness of the innovation or be impacted by its personal aspects. In fact, the term nonuser only indicated that these teachers were not fully engaged with the innovation for a variety of reasons, but did not claim that they had not started exploring or using it. 14.3% of teachers in the Self-type category were in Stage 1 and aware about the innovation and were interested in learning more about integrating ICT in curriculum. 4.8% of teachers with Self-type concerns were in Stage 2 and uncertain about the demands of the innovation. They considered potential conflicts of the innovation with existing structures or personal commitment. In the Task-type category, 22.2% of teachers seemed to explore management issues related to efficiency, organizing, managing, and scheduling ICT integration in curriculum. 6.4% of educators had developed Impact-type of concerns and were in particular interested in collaborating with others to maximize the use of ICT integration in curriculum

Research question 2

1. *What are the relationships between elementary educators' current Stages of Concern and their demographic background?*

In this section, I present the statistical analyses of the degree of association between Stages of Concern and variables of the demographic data. More precisely, in order to answer Research question 2, I calculated the appropriate measure of association between Stages of Concern of respondents and each of the independent variables: gender, age, level of education, teaching experience, reported years of computer use in teaching, perception of computer expertise, number of hours of technology training during the past two years and number of ICT skills used in teaching and for personal use. The corresponding value for each demographic variable is presented in Table 18 below.

Table 18: Demographic variables considered in the statistical tests of the degree of association

Demographic Variables	Response Choices
Gender	Male, Female
Age	20-29, 30-39, 40-49, 50+
Education level	Bachelor, Pb+15, Masters, Doctorate
Teaching Experience	0-5, 6-10, 11-15, 16-20, 21-25, over 25
Years of computer use in teaching	None, less than I year, 1-2 years, 2-3 years, 3-5 years, more than 5 years
Number of Hours of Technology Training during past two years	None, 1-9H, 10-19H, 20-29H, 40H or more
Number of ICT skills used in teaching and for personal use	0-3, 4-7, 8-11, 12-15, 16-19
Perception of Computer Expertise	Nonuser, Novice, Intermediate, Experienced

Statistical analyses: Degree of association of Stages of Concern and the demographic data

For my analysis in this section of the study, I used Contingency tables and χ^2 Tests of Independence to measure the degree of association of the respondents' Stages of Concern and their demographic data. I used an alpha level of 0.05 for all statistical tests. Table 19 (p. 137) summarizes the findings from this phase of the analysis. The following paragraph is the statement that I used as a template to determine the degree of association for each demographic data:

> A χ^2 Test of Independence based on a contingency table (Table #) was used to examine the role of (variable) and test the null hypothesis that there was no relation between the respondents' (variable) and their Stage of Concern with regard to ICT integration in curriculum. The χ^2 value was --- which is --- than the threshold value of --- at --- degrees of freedom at 0.05. Therefore, there was no relationship between the Stages of Concern and the (variable) of teachers. **OR** Therefore, the null hypothesis of no relation was rejected and it was concluded that there was a relationship between teachers' (variable) and their Stages of Concern.

In case of ICT skills used in teaching, χ^2 value was 35.20, which is lower but very close to the threshold value of 39.25 at 16 degrees of freedom at 0.05. The value of χ^2 was close enough to warrant some further testing especially because these are ordinal variables. Spearman correlation, a non-parametric measure of correlation, would be more appropriate. Spearman rank correlation coefficient in this case was 0.47, which indicated a positive relationship between the Stages of Concern of elementary educators and the number of skills they used in their teaching.

I should mention that before carrying a statistical test of association between perception of computer expertise and Stages of Concern, I decided to explore teachers' perception of their computer expertise since each individual teacher perceived his/her level of computer expertise based on his/her own judgment. Therefore, I carried out a χ^2 Test of Independence based on the Contingency table for highest observed number of ICT skills used in teaching or for personal use to test the null hypothesis of no relation between the

Table 19: Summary of findings concerning the degree of association of Stages of Concern and the demographic data (P=0.05)

Demographic Variables	X^2	Threshold value	Degree of freedom	Relation between respondents' demographic variables and their Stages of Concern
Gender	5.77	9.49	4	No relationship
Age	10.51	21.03	12	No relationship
Level of Education	20.66	15.51	8	Yes relationship
Teaching Experience	23.52	31.41	20	No relationship
Years of computer use in teaching	11.30	31.41	20	No relationship
Number of hours of technology training during the past two years	43.24	26.30	16	Yes relationship
Number of ICT skills used in teaching	35.20	39.25	16	Based on Spearman rank correlation coefficient of 0.47: Yes relationship
Number of ICT skills used for personal use	43.61	39.25	16	Yes relationship
Perception of Computer Expertise	20.51	15.51	8	Yes relationship

respondents' perception of computer expertise and the highest number of ICT skills used either in teaching or personal use. χ^2 value was 46.73 which was higher than the threshold value of 26.13 at 16 degrees of freedom at 0.05. Therefore, the null hypothesis of no relation was rejected, and I concluded that there was a relationship between number of ICT skills used by teachers and their perceptions of computer expertise.

Summary and conclusions

The conclusions in this section are based upon the two research questions that guided the first phase of the mixed methods study. The *SoCQ* regrouped the concerns of the 63 elementary educators who participated in this study into three main categories of concerns with regard to integrating ICT in curriculum: Self, Task and Impact types of concerns. These different types of concerns indicated where these educators were in their personal and professional involvement with the use of ICT in curriculum. In responding to research question 1, 71.4% of concerns were self, 22.2% were task and 6.4% were impact.

Overall, these results are similar to those of some other concern studies (Askar & Uley, 2001; Liu and Huang 2005; Rakes & Casey, 2002), where a large proportion of teachers examined were still at the self-oriented Stages of Concern. In fact, based on some national and international survey results (Pelgrum, 2001; Plante & Beattie, 2004; US Department of Education, 1999), large proportions of teachers still do not feel comfortable using ICT in their teaching.

Researchers suggest that the Stages of Concern about an innovation progress from little or no concern about the innovation to personal or self concerns, task-type concerns about adopting the innovation and finally to impact-type concerns which suggest full involvement with the innovation (Fuller, 1969; Hall et al., 1979; Hall & Hord, 1984; George et al., 2006). The Group Concerns Profile in this study exhibited intense early personal concerns and task concerns. In order for educators to move toward higher desirable impact concerns, the more intense self-concerns and task concerns should be lowered. When something new is introduced to teachers, their initial concerns revolve around the effect of the innovation on them personally. When this type of concern is resolved, teachers will focus more on task-related issues that involve the innovation before starting to demonstrate concerns about the impact of the innovation on learners. George et al. (2006) explain that methods of intervention and conditions associated with implementation of an innovation are more critical variables than such demographic variables as a user's age, sex, teaching experience, etc. The increasing support for this theory is also evidenced by the work of other researchers, including Atkins and Vasu (2000).

The analysis of Concerns Profile of educators and the open-ended statements included in questionnaires in phase one of the mixed methods study identified five categories of concerns and challenges that might have created barriers to ICT integration in curriculum: concerns related to time constraints; concerns related to proper technology equipment; concerns related to lack of information and/or proper technology training; concerns related to onsite contact people; and concerns related to ICT literacy and integration. These concerns reflected the respondents' self and task type anxiety and preoccupation with regard to the logistics and management issues related to the integration of ICT in their teaching.

To respond the second research question, the statistical analyses of degree of association of the Stages of Concern and Demographic Data suggested that there was no relationship between an elementary educator's gender, age, teaching experience and length of computer use in teaching and their Stages of Concern about integrating ICT in curriculum. The change process that involves integrating ICT in curriculum is one that all educators of both genders and all ages and with different teaching experience might go through. In fact, all the educators in the sample had access to computers and internet at home, which suggests that these educators had already become involved with ICT on a personal basis despite the fact that they might be minimally involved with ICT integration in curriculum at school. In a similar study conducted by Atkins and Vasu (2000) at the middle school level, no relationship between teachers' Stages of Concern and variables such as age, gender, and teaching experience was reported.

The lack of relationship between the Stages of Concern of the responding educators in this study and the number of years they had used computers in teaching was another indicator that the simple fact of using computers by teachers does not reflect its meaningful integration in curriculum, as some teachers might only use computers for clerical tasks such as attendance, report cards and typing assignments and tests. Interestingly, Canadian school principals also reported that despite the fact that a large proportion of their teachers possess the required technical skills for administrative purposes, many teachers are still not adequately prepared to effectively engage students in using ICT (Plante & Beattie, 2004).

The statistical analyses showed a positive relationship between educators Stages of Concern about integrating ICT in curriculum and the number of hours of technology training/workshops taken over the past two years, their perception of computer expertise, number of ICT skills used in teaching and for personal use, and their education level. These findings support the argument that concerns will vary depending on the amount of one's knowledge about an innovation and one's experience with that innovation (Hall et al., 1979), and in line with Atkins' work (2000) where a relationship between middle school teachers' Stages of Concern and computer confidence level and number of hours of technology training was reported. In fact, of the four teachers in this study who were on the highest SoC (Stage 5-Collaboration), three had spent 40 hours or more on technology training in the past two years. The type of technology activities taken by these teachers were also advanced, with one having a Master of Educational Technology and being a member of District Educational Technology Committee, a second teacher with a TLITE Diploma (Teaching and Learning in an Information Technology Environment), and a third who was very involved with technology-related activities outside of the school, with a Douglas college IT diploma in addition to her Masters degree. The only teacher in this category (with only 1-9 hours of technology training) was a teacher librarian with

25 years of teaching experience. However, a teacher-librarian assignment involves full involvement with technology. These findings also confirm the relationship between education level and the SoC of these educators. Another evidence to support this relationship is the education background of the four teachers on Stage 3 (Management). Three of these teachers had completed a TLITE Diploma and were informed about educational technology, and a fourth had a Masters degree. As discussed by Becker (1994, 2000), exemplary computer-using teachers in his studies had higher levels of technical skills and more formal training with regard to educational technology. Again, these findings reveal that it is the way ICT is used in teaching that determines its impact on learning, and the type of training and the way educators integrate their ICT skills into their teaching would make the use of technology meaningful and significant.

The following chapter presents the findings from the phase two of the mixed methods study, the qualitative phase and explores the personal responses of elementary educators with regard to the integration of ICT in their teaching in their own terms, and attempts to expand the findings of the quantitative phase to another level of breadth and depth.

CHAPTER FIVE
ANALYSIS OF FINDINGS FROM PHASE TWO: INTERVIEW ANALYSIS

Drops that gather one by one, finally become a sea.
-Iranian proverb

Phase one of the study consisted of a quantitative survey that I used to gather data on Stages of Concern about ICT integration and also used to identify individual elementary educators for interviews in the second phase. To further define this study, I purposefully selected interview participants for phase two, including one school principal and 16 elementary teachers from each identified SoC. I conducted the qualitative interviews to address the following question:

1. What are elementary educators' responses (views, feelings, concerns, perceptions and experiences) toward the diffusion and integration of ICT in their practice?

In the following sections, I describe and discuss the findings of the qualitative phase of the mixed methods study, the one-to-one interviews. I first present the characteristics of the study sample. Second, I describe and discuss the findings concerning the emerging categories from each content area including the views, the feelings, the concerns, the personal experiences and the perceptions of ICT characteristics with regard to the integration of ICT by referring to the elementary educators' comments during the interviews. I discussed methods of data analysis including coding and categorizing in detail in chapter three.

In order to maximize the efficiency of this phase of the study, I used HyperResearch to retrieve all cases that included the codes gathered in each category and their related quotations. This assistive software uses Boolean logic to show the relationships of two or more terms to one another and uses three Boolean operators: AND, OR, and NOT. In order to use this option, I had to formulate a hypothesis. For example, to retrieve all the cases in the category of *Status of ICT in schools*, I formulated the following hypothesis that included all those codes related to this category: IF *ICT underutilization* OR *schools behind* OR *ICT role in school's life* OR *lack of background* OR *frustration due to ICT* OR *ICT cost* OR *ICT and politics* OR *lack of interest* THEN *STATUS of ICT INTEGRATION STATUS IN SCHOOLS*. As a result, I could retrieve all the cases that contained at least one of the codes in the hypothesis. I then found the meaning unit corresponding to each code and re-contextualize it by reading through the interviewee's answers.

Sample characteristics

As explained earlier and in chapter three, the sample for the second phase of this study consisted of 16 teachers and one principal in District X who voluntarily participated in the interviews, starting on May 30 and ending on June

26, 2008. (Table 5, p. 102). Table 20 (p. 146) details demographic characteristics of the elementary educators who participated in the second phase of this study.

Looking at the sample demographic characteristics (Table 20), the only educator who seemed to be an outlier was Chloe because despite her position as a computer and teacher-librarian, she was falling on Stage 0 (Unconcerned) as evident from the *SoCQ* data analysis. As explained by George et al. (2006), the *SoCQ* interpretations are based on numerical data and should only be treated as hypotheses, and further information such as demographic information and interview data will allow a more accurate analysis of respondents' Stages of Concern about an innovation. Through the interviews, I could therefore have a better understanding of the relevance of the Stages of Concern of elementary educators. However, this chapter focuses on the descriptive report of elementary educators' personal responses to ICT integration in their practice. In chapter 6, I integrate and interpret both quantitative and qualitative findings and therefore, I will be able to thoroughly investigate the relationship between the Stages of Concern of educators and their personal views and demographic background, and identify any outliers with more certainty.

Research question 1

1. *What are elementary educators' responses (views, feelings, concerns, perceptions and experiences) toward the diffusion and integration of ICT in their practice?*

In order to answer this question, I coded the interview transcripts and identified

Table 20: **Summary of interviewees' demographic information**

Name*/ Gender	Highest Stage of Concern	Teaching Assignment	Age	Highest Degree	Teaching Experience	Computer use in teaching	Number of ICT skills	Computer expertise Perception
Beverly	0 Unconcerned	3	50+	Bachelor	20	3-5 yrs	6	Novice
Chloe	0 Unconcerned	Library/gifted computers	40-49	Masters	16	3-5 yrs	15	Intermediate
Elizabeth	0 Unconcerned	5	50+	Bachelor	30	> 5 yrs	3	Novice
Jeanette	0 Unconcerned	3	20-29	Bachelor	2	2-3 yrs	9	Intermediate
Olivia	0 Unconcerned	2/3	50+	Bachelor	25	> 5 yrs	8	Intermediate
Sara	0 Unconcerned innovation user	1/2	50+	Bachelor	15	> 5 yrs	6	Novice
Dan	1 Informational	2/3 FI	30-39	Bachelor	7	2-3 yrs	7	Intermediate
Kim	1 Informational	2 FI	40-49	Bachelor	25	> 5 yrs	13	Intermediate

* Teachers' real names have been replaced by pseudonyms.

Name*/ Gender	Highest Stage of Concern	Teaching Assignment	Age	Highest Degree	Teaching Experience	Computer use in teaching	Number of ICT skills	Computer expertise Perception
Jim	2 Personal	4/5	30-39	Masters	7	3-5 yrs	14	Intermediate
George	2 Personal	1/2/Music	50+	Pb +15	32	> 5 yrs	9	Intermediate
Cassie	3 Management	Student Services	40-49	Pb +15	23	> 5 yrs	17	Experienced
Doris	3 Management	5	40-49	Pb +15	22	1-2 yrs	11	Intermediate
Ron	3 Management	2/3/ computers	40-49	Pb +15	8	> 5 yrs	17	Experienced
Paul	3 Management	K	50+	Masters	18	> 5 yrs	11	Experienced
Dale	5 Collaboration	Principal/4/5	40-49	Masters	16	3-5 years	16	Experienced
Katherine	5 Collaboration	Librarian	30-39	Bachelor	10	> 5 yrs	16	Experienced
Sue	5 Collaboration	4/5	40-49	Masters	15	3-5 yrs	18	Experienced

* Teachers' real names have been replaced by pseudonyms.

the emerging categories from each of the 5 content areas of views, feelings, concerns, personal experiences and perceptions of ICT characteristics with regard to the integration of ICT, as described in chapter three. As explained in the methodology section, by sorting the interview texts into five areas, I could answer the research question by carefully exploring the meaning units and the ideas conveyed by participants, while focussing on smaller sections of the text. Table 21 (p. 148) summarizes the emerging categories for each content area. In what follows, I describe these categories by referring to the elementary educators' comments during the interviews.

Table 21: Emerging categories corresponding to each content area of interviews

Content areas	Number of codes	Emerging Categories
Views	34	(a) different levels of change (b) ICT integration status in schools (c) educators' role (d) impact of ICT on learning (e) ICT as a tool
Feelings	35	(a) proactive feelings (b) reactive feelings (c) mixed feelings.
Concerns	30	(a) ICT safety (b) educational challenges (c) infrastructure.
Personal Experiences	21	(a) ICT equipment availability and use (b) ICT use (c) barriers to ICT use (d) support for ICT use
Perceptions of ICT characteristics	41	(a) relative advantages (b) compatibility (c) complexity (d) trialibility (e) observability

At certain points during the conversational interviews, some common and similar meanings and themes were repeated and emphasized by teachers in different content areas. I, therefore, decided to briefly refer to the redundant ideas in each section for accuracy, and only include those statements that added new points to the findings. I should mention that in this chapter, I present common themes expressed by the participating educators no matter what their Stages of Concern were. In Chapter six where I combine the findings of both quantitative and qualitative phases, I also have the opportunity to identify the general trend for each SoC and compare and contrast them across the stages. For an easy reference however, I include the SoC of each teacher beside his/her name in this chapter.

The views of elementary educators with regard to ICT integration

The elementary educators in this study developed their views with regard to ICT integration by reflecting on the many changes that they witnessed on a regular basis in relation to their own communities, their students' involvement with ICT and their roles as teachers and educators as well as their thoughts on the impact of ICT on learning and the use of ICT as a tool in their practice. Overall, I identified five major categories to regroup the 70 statements that reflected the views of elementary educators with regard to ICT integration (Table 22, 151): (a) different levels of change, (b) ICT integration status in schools (c) educators' role, (d) impact of ICT on learning, and (e) ICT as a tool.

Different levels of change

As highlighted in Table 22 (p. 151), ten elementary educators in the sample study reflected on the changes occurring on a daily basis around them. The twelve statements by these educators targeted changes at different levels in their surroundings: at the individual level, at the school level, at the workforce level, at the society level and at the world level. As part of their interviews, these educators mentioned that they had started to notice the gradual changes happening in their schools concerning the integration of ICT, and they could not see any drawbacks or reasons to halt. As Cassie (Stage 3) indicated: "I think it's part of our children's lives, our students' lives and it's not going to stop because certain people don't want it to move forward." Jim (Stage 1), a young classroom teacher and Department Head and Elizabeth (Stage 0), a more experienced classroom teacher, both with different levels of computer expertise shared similar observations as they both felt that they were all moving toward integrating ICT in their practice. As Elizabeth mentioned:

> You can't avoid change and technology and modern trends and that's just where society and learning is going...you need computers to function so even though I find it frustrating and it's slow process, we have to keep moving forward, we can't ignore them.

Two teachers explained that their views about technology and its integration in their teaching had changed as a result of personal and professional development or sometimes just by becoming more involved with ICT equipment. Doris (Stage 3), an experienced classroom teacher explained that she initially thought that "it was a waste of time to have computers and even for elementary school kids to go to computer lab". However, through professional development,

Table 22: Codes and categories from content analysis of texts concerning the views of elementary educators with regard to ICT integration

Categories	Different levels of change	ICT integration status in schools	Educators' role	Impact of ICT on learning	ICT as a tool
Codes	changing views (2) changing schools (1) changing world (4) changing society (1) changing workplace(4)	ICT underutilization (4) schools behind (1) ICT role in school's life (1) lack of background (2) frustration due to ICT (1) ICT cost (4) ICT and politics (1) lack of interest (1)	good teachers (1) teachers' obligation toward ICT (2) different learners (1) ICT role in children's life (1) student's preparation (2) ICT as teacher (2) proactive with ICT (1) ICT awareness at young age (1) ICT and grade level (2) leadership role (1)	ICT and learning (6) ICT and learning disabilities (2) ICT and learning needs (2) ICT & curriculum (2) ICT integration in all subjects (2) ICT skills (1) children engaged with ICT (8)	a different tool (1) ICT as management tool (1) ICT as information tool (1) different resources (1)
Number of codes	5	8	10	7	4
Number of respondents	10	10	12	12	3
Number of Statements	12	15	14	23	4

she began to view educational technology differently: "...and then I took the T-LITE course and it really opened my eyes as to what can be done and the value that technology can play in the classroom". These views were shared by Katherine (Stage 5), the teacher-librarian who believed that her UBC courses had transformed her views about educational technology: "...so doing 30 credits of library is what it took and everybody is not going to do that, so it means that there needs to be some other form of education going on through ProD...any other way of being supported...".

Some teachers referred to the world of children, which has changed dramatically as a result of the fast moving technology, and believed that schools needed to respond to the new technological demands of children and prepare them for the real world. Ron (Stage 3), an experienced classroom and computer teacher and a technology learning team facilitator mentioned: "...if I imagine that we didn't have ICT integrated into our curriculum and then we would send them home to a totally different world where their home is full of it, I don't think we would be preparing well rounded individuals". Kim (Stage 1) went one step further to envision the school of the future and believed that every student should have his/her own laptop with access to the internet and software programs: "...my husband works for a textbook publishing company and they already know that the textbook is going to be going the way of the dinosaur... his company is already developing disks and computer programs to address that...".

ICT integration status in schools

Overall, ten elementary educators expressed themselves in this category through the fifteen statements they made in the interviews (Table 22, 151). Four elementary educators demonstrated their concerns with regard to the underutilization of ICT in their schools as they believed that the ICT equipment was not used to its full potential by themselves or their colleagues. Katherine (Stage 5), the teacher-librarian and the technology site contact expressed concern by referring to the ICT equipment in her school as “highly underutilized and misunderstood” and not used to “the potential of what is possible”, which she related to the “lack of qualifications and teaching”. She believed the use of technology within teaching, suffers from a serious problem that concerned her very much: “...I think we are preparing some of the kids or if any kids for high school properly...I see in middle school grade 8 kids not knowing anything other than Google and that seriously concerns me”.

Kim (Stage 1), an experienced classroom teacher looked at the issue discussed by Katherine (Stage 5) through a different lens as she believed that her school was behind in the use of technology because they did not have enough ICT equipment. She believed that computers had become an “integral part of life” and that due to the fast-changing technology and financial constraints, the school district could not “keep up” and was “lagging in being able to offer up to date equipment to use”, and as a result, there was a huge gap between children’s world at school and at home with relation to the available technology. She strongly believed that each classroom should have more than one computer "for students to be able to use them on a regular basis without going to the computer lab".

Paul (Stage 3), a kindergarten teacher with a higher level of computer expertise believed that a shortcomings in equipment and in the capacity to integrate ICT were still constraints and challenges to overcome in his teaching: "Well, how well has [ICT] been integrated into my practice? I think that there are still some ways to go". He believed that he faced some constraints "in terms of time and also in terms of what the computers can just do". He also felt that there were some restrictions in his school with regard to what they could download or the different programs they could use. He explained: "...so there are certain fairly narrow parameters and I think once those get widened a little bit and students do have more access to technology, that it would become more of a force in their daily lives". He compared his students' actual access to computer to "having one book in a classroom", which they shared but he felt that the "amount of useful time that [they] were getting of it [was] fairly limited". Despite the fact that they had some access to the computer lab, he did not find it very useful as he mentioned: "We are getting familiar with so many equipment but it's not proving it's useful as I would like it to be so although, it is a part of our lives, it's a relatively small part at this point in time".

Cassie (Stage 3), a resource and skill development teacher and the itinerant district resource teacher for special education technology, drew attention to issues related to sustainability of technology in schools and believed that technology use was maintained in her school because of the interested people: "… I've tried to encourage it so I think we have gone from 20% support five years ago to 100% support in our school now but that's only because those of us who are interested, they keep it rolling".

Teachers with lower level of expertise such as Olivia (Stage 0), Jim (Stage 2) and Elizabeth (Stage 0) and even some teachers with more technology expertise such as Doris (Stage 3) and Chloe believed that their lack of knowledge and relevant background prevented them from using the ICT equipment in their school to its full potential, despite their interest, and wished for more in-service in this regard. However, this belief and the enthusiasm for ICT integration was not shared by all.

George (Stage 2), a primary classroom and music teacher, a department head and a former union leader had stronger opinions than any other elementary educator in this sample: "…in primary, we can make a much better use of resources than spending 60,000 on a lab, which you know the equipment will be obsolete in three or four years…What are the kids really getting out of it?" He believed that too much money was being spent on the computer laboratories where kids only spent 40 to 80 minutes per week. He did not see this as "a really effective use of financial resources" and was concerned about the lack of resources for learning assistance teachers at primary level, resource room, and ESL. He went further and criticized a market-driven system that he believed was influencing the school system: "The market place dictates what we do, write the upgrade… so we are victim of planned obsolescence by the capitalist system."

Sara (Stage 0), an experienced primary teacher was unsure if she had the desire to integrate ICT in her teaching: "...it's never been something that's interested me all that much...I kind of wished that I did know more, but I don't know I wish for that enough to really go to the ends to make that big change...". She did not think that using computers in her teaching would make her a better teacher: "...you have to prove to me that it would make me a better teacher, I don't know".

Educators' role

Through the fourteen statements made in this category (Table 22, 151), twelve elementary educators expressed their views on the educators' role, mostly as a result of the increasing involvement of children with technology. They believed that the new generation of children related to technology much more than the previous generation and were often more of an expert than their own teachers. Dan (Stage 1), a resource teacher perceived computers as "a different teacher" to today's children. Cassie (Stage 3) saw "a big role in it when the children leave elementary to middle school", and she believed that the new generation of children were "different learners" and could "multi-task": "They don't want to listen to teachers, they'd rather listen to someone on a screen, their life is screen, screen type whether it's TV, video games. They would probably listen better to rules if it was from someone on the screen".

There were some differences of opinion as to what the role of the teacher was in the technology-infused schools. Cassie (Stage 3) and Chloe both specialist teachers in their fields and highly involved with computers, expressed themselves differently. On one hand, Chloe believed that despite the excitement that ICT equipment such as Smartboard could bring to a classroom, she did not think that it could replace a good teacher. On the other hand, Cassie envisioned a different future for teachers: "One day, we won't see teachers up there, we will see a computer screen up there."

Some statements focused on the necessity of preparing students for the real world, and again Katherine (Stage 5) expressed concerns about the lack of proper preparation of students in elementary schools for their later transition to the middle school. Both Elizabeth (Stage 0) and Sue (Stage 5), with different levels of technology expertise, believed that it was a teacher's responsibility to integrate ICT in her teaching. Sue, a computer expert believed that teachers "...have an obligation to advance with the technology and to see ways [they] can integrate it". Elizabeth, a novice user shared similar views despite her poor computer abilities: "We have to move forward with the kids even though I am feeling left behind because I have not kept up with the computer skills".

Paul (Stage 3), a Kindergarten teacher believed that ICT awareness should start at a young age in schools at the Kindergarten level: "...they do need some practice on the computer, ... have some awareness of what the internet is and what the procedures are and how to use the equipment".

George (Stage 2) and Sara (Stage 0), both primary teachers did not agree with the others and questioned the integration of ICT at primary level. Sara, not truly interested in ICT and with lower level of computer expertise, was not sure about the value of ICT at elementary level: "I'm so certain that it is in upper grades,...not as certain that it is in a K to 5 school, I think it's nice...certainly nothing wrong with it...it has some advantages whether or not it's like really important...". George who had a higher level of expertise did not believe that ICT integration was necessary at primary level and was uncertain about technology advantages for kids in Kindergarten to Grade 3: "...some computer experts...in Discover magazine... have said...maybe there is not so much use for computers in elementary schools, and...I would probably lean to that point of view", however, he was more positive about word processing: "...but if we are talking about word processing, then that's another story".

Finally, a principal, Dale (Stage 5), drew attention to the importance of leadership concerning the integration of ICT in teaching. The leadership encouragement and reinforcement of ICT integration, and good role modelling in schools were emphasized by him: "...as leaders, we need to model first and foremost, not being experts in technology but being humble, fearless learners in the process...". He also emphasized the importance of supporting teachers in their discovery of educational technology: "...as leaders, we need to support educators in providing the time and space, engaging dialogue to help break down those paradigms and those barriers that are preventing our educators from being humble themselves".

The impact of ICT on learning

Through their twenty three statements, twelve elementary educators reflected on whether ICT had an impact on their students' learning, and also discussed the relevance of ICT use in teaching (Table 22, 151). All these elementary educators—no matter what their degree of ICT integration in teaching was—believed that students were very engaged and motivated when using ICT. Ron (Stage 3) explained how students were never tired when working with ICT: "It's very high engagement, there is never any—well very rarely any—hesitation or hesitance to start any project. It's always eagerness and excitement and they all want to finish everything." Dale (Stage 5), a principal with a high level of computer expertise described the relationship of today's children with the technology as follows: "When you see a child engaged in the classroom using technology to enhance their learning, you see a comfort level...a level of engagement and...success that may not come about having them deal in more traditional senses with paper, pencil". He related this high engagement to the familiarity of the new generation with technology as they have "never not known the internet": "...this is most comfortable to them. When they're pulled away from that, they would tend to shut down because it's not as comfortable. So when we provide them with those ICT, you know tools, they flourish".

According to seven teachers, ICT responded to different learning needs of their students from strong students to weaker students and students with learning disabilities. Ron (Stage 3) explained how the special nature of ICT gave him the flexibility to respond to different needs of his students: "I also find that it's very easy to make computer assignments open-ended to make sure that the lower students are easily successful and at the other end that the more able students can go as far as they want to". Two teachers out of seven highlighted the positive impact of ICT on their learning disable students. Doris (Stage 3), a classroom teacher with three learning disable students explained how technology had helped her to attend to their learning needs simultaneously while she taught other students: "...one student hardly wrote anything down, wasn't really interested, and he does [now] his spelling and his journal and his stories anytime we write on a computer in the classroom". Doris was successful in including this student in classroom activities through the use of computers: "...so he'll go to the computer and I will like spelling old fashion ways, spelling pre-test and he just types it in front of the computer".

Jim (Stage 2) and Jeannette (Stage 0), two young teachers expressed their views on the relationship between students' learning and their increased level of motivation as a result of ICT use differently. Jim was positive about the impact of ICT on his students' learning:" The biggest reason being the motivation level of your students increases and I think when motivation increases for students it can only enhance their learning and enhance their skill based and their knowledge level". However, Jeanette perceived learning through ICT differently: "As far as actually learning the concepts of things, learning...the core curriculum, I don't think it's any different,...I don't think they learn any better, they might be a little more motivated, it might be more fun so...", and she believed that it was "good to incorporate it for those reasons".

Based on statements made by Beverly (Stage 0), an experienced classroom teacher and Katherine (Stage 5), the librarian, it seemed that there was still some misunderstanding in the school communities with regard to the curricular direction concerning ICT integration. Beverley believed that teachers would have tried harder to learn more about technology if it was part of the curriculum as they had "to know how to teach it to their children themselves…": "Because it's not a part of the curriculum right now, I am not making a huge effort or as a big effort as I should but if we had to, then I probably would." Katherine, the teacher librarian, pointed out Beverly's lack of knowledge about ICT integration in curriculum: "It is already in the curriculum and a lot of people don't know that it's not a curriculum on its own. It's integrated within the curriculum as we are speaking. It's already there".

Dale (Stage 5), the principal, shared his views and visions on the ideal integration of ICT in teaching whereby the focus would be on learning and not the tools. He compared technology to a pen used to write down thoughts that is only noticed when "it runs out of ink": "…the technology needs to be transparent, to the fish the water is invisible… it can't be about the technology, it has to be about the learning. The tool needs to be transparent…"

ICT as a tool

Three teachers through their four statements shared their views with regard to ICT integration by discussing the role of ICT as a tool in their teaching (Table 22, 151). Chloe believed that Smartboard was a tool different from any other that she has ever experienced in her teaching. Elizabeth (Stage 0) perceived computer as just another tool, which should be complemented by other resources such as books and encyclopaedia. Educators discussed ways they used ICT in their teaching in more detail in the content area related to personal experience with regard to ICT integration.

The feelings of elementary educators with regard to ICT integration

Through their 34 statements (Table 23, p. 163), elementary educators in this study discussed those aspects of ICT that triggered either positive or negative or mixed feelings in them. In the following sections, I discuss the aspects of ICT that resulted in: (a) Positive feelings (b) Negative feelings, and (c) Mixed feelings.

Positive feelings

Five elementary educators expressed positive feelings toward the integration of ICT in their teaching because of its changing and exciting nature (Table 23, p. 163). These teachers felt comfortable, excited and proactive in their use of ICT. Cassie (Stage 3) felt excited about "where it's going" and she wanted her "students feel comfortable." These educators also exhibited a welcoming attitude toward any change that allowed them approach their teaching differently. Ron (Stage 3) was excited because ICT allowed him to learn more: "...it's always changing and I know that some people don't like that aspect of it but for me, I find that exciting and it's easy for me so...I like that change, I look forward to it". Dale (Stage 5), the principal who considered himself as "a very much a proponent of the integrated technology", expressed himself as follows: "Most change in the world is always viewed as negative or

Table 23: Codes and categories from content analysis of texts concerning the feelings of elementary educators with regard to ICT integration

Categories	Positive feelings	Negative feelings	Mixed feelings
Codes	excitement (2) comfort (1) humility (1) proactive (1) paradigm shift (1) a different tool (1) positive change (1)	nervousness & lack of confidence (2) anxiety (1) frustration (1) slow ICT progress (1) equipment issues (1) lack of support (1) meaningful integration (1)	excitement & frustration (1) pleasure & frustration (2) advantages and concerns (1) positive feelings & apprehension (1) pleasure & intimidation (1) comfort & frustration (1) pleasure & uncertainty (1) information overload (2) excitement about reading & writing (1) lack of human interaction (1) obesity (1) ICT cost (1) Equipment issues (1) Philosophical issues (1) good teacher (1) teachers learning from students (1)
Number of codes	12	7	16
Number of respondents	5	4	8
Number of Statements	8	8	18

difficult in the beginning, but I think by embracing it and working with it, I think we can make it a very very [*sic*] positive piece in everyone's life…".

Negative feelings

Four teachers expressed negative and reactive feelings concerning the integration of ICT in their practice (Table 23, p. 163). This did not mean that these teachers were reluctant to use ICT but rather they expressed feelings of nervousness, anxiety, frustration and lack of confidence. For example, Beverly (Stage 0) expressed herself as follows: "I feel very nervous about it because I don't feel confident enough… because I am not confident enough myself, I don't feel that I am able to teach students properly."

Despite her high level of ICT expertise, Katherine (Stage 5) felt that her anxiety with regard to ICT integration was due to the slow process that involved this integration by other teachers: "I feel anxious, I feel like it's such a huge battle and such a huge hill to climb that it feels almost hopeless at the moment but I know that's not the case". Jim (Stage 2) felt that the administrators and districts needed to become more involved with technology integration: "…administrators have to be more immersed in technology as well because they have to be part of the group at their particular school that thrives on technology, and I think I would like to see that more from our district…"

Mixed feelings

Eight teachers reflected mixed feelings with regard to the integration of ICT in their teaching (Table 23, p. 163). These teachers expressed proactive and positive feelings such as excitement, comfort and pleasure when using the equipment available to them. At the same time, they exhibited negative feelings of apprehension, frustration, intimidation, uncertainty and concerns in this regard. Doris's (Stage 3) expression of these mixed feelings portrayed the feelings shared by many of her colleagues in this category:

> So there are two things, there is excitement there and the vision and yes I can see where we can go with it but then the reality comes in, as oh, I don't have enough time or materials or my own knowledge isn't where I need it. So, I have got two conflicting sort of feelings, frustration and excitement, worrying away which I suppose it's in anything that happens when you learn.

The positive feelings of teachers were triggered by different ICT-based activities that attracted their students' attention and engaged them with their work such as reading, writing, research and presentation. However, their negative feelings were stimulated by a wide range of reasons from basic technical issues to more spiritual and philosophical aspects of teaching. Elizabeth (Stage 0) was excited about her students' enthusiasm about ICT but felt frustrated because she did not have enough time to check all the websites related to a topic of interest and evaluate the appropriateness of the available information, and as a result she could not help her students in the limited time they spent in computer lab. Jeannette (Stage 0) was pleased with her students' excitement about ICT but was concerned about the technical issues related to ICT equipment such as malfunctioning or crashing, and she felt that she did not encounter similar issues when using books: "...a book is not going to crash on you and you will be able to open it...you are relying on a lot more variables I guess when you are using a computer or a Smartboard."

Olivia (Stage 0) was supportive of the diffusion of ICT in schools as she felt that students with different backgrounds would benefit from it, however she expressed occasional feelings of intimidation as she was overwhelmed by the emerging volume of new information and knowledge despite the fact that she was open to learning. She mentioned that occasionally, she learned from her students as they knew more than her but she sometimes was reluctant to learn more because she was feeling "overloaded". She did not feel that she would want to get involved in exchanging e-mails with students and parents, and spending time at home to reply to all the received messages. She continued to say: "... sometimes face-to-face communication is also good and I wouldn't want that to go away and like a lot of teachers are letting parents e-mail them and students e-mail them, I am not at that point yet."

Sharing similar feelings with regard to human interaction, George (Stage 2) added new items to the list of issues that evoked negative feelings in him with regard to the use of ICT in his practice: "The negative side is my concern about: are we getting bang for our buck, is it financially really effective and are kids glued to the computer screen or the TV enough already?" He related issues such as obesity and the lack of interaction to the use of ICT:

> "...lately people staring at screens, you know, it's not really as interactive as real moving around with real manipulatives...so I am also concerned about the future with distant education and cutting humans out of the process...we are finding from research now that more interactions with humans is what really drives any kind of progress in education whether you are a kid or an adult...it's learning community relationships that are key, not pieces of hardware.

Finally, Chloe highlighted feelings that were triggered by educational issues related to the philosophical beliefs of educators concerning the use of ICT in their practice. On one hand, she was apprehensive and on the other hand, she was excited about the many advantages of ICT. She related her apprehension to her beliefs about the ways ICT should be used in schools:

> I have been apprehensive about it even though I am a technology teacher...I think I like to use it on a practical sense so when I use it, for me, it's not a toy for the kids at all..., so we have this huge philosophical debate because [my principal] feels you can put kids on a computer, and they'll just learn and my thing is you put kids on a computer, they are going to play...I feel at home, it could be a toy but not here so I enjoy using the technology. I think it adds a huge dimension. I think number one is you need to have an excellent teacher in order to get anything from it...

The concerns of elementary educators with regard to ICT integration

In this content area, I explored the concerns of elementary educators with regard to ICT integration in their practice in their own terms. Elementary educators expressed their concerns by referring to issues related to educational challenges that they encountered on a regular basis when using ICT in their practice including issues related to ICT safety for their students in particular, and ICT-related infrastructure in general. These concerns were conveyed through the 68 statements that they made which were subsequently regrouped in three major categories (Table 24, p. 168): (a) ICT safety (b) Educational challenges, and (c) Infrastructure.

ICT safety

Seven elementary educators reflected concerns related to the safety issues that were directly connected to the use of Internet and Online

Table 24: Codes and categories from content analysis of texts about the concerns of elementary educators with regard to ICT integration

Categories	ICT Safety	Educators' Challenges	Infrastructure
Codes	technology safety issues (7) adults' unawareness (1) ICT underutilization (1) solutions to technology safety issues (2) proactive with technology (1)	coordination issues (2) solutions to coordination issues (1) teachers' apprehension (1) dependability issues (1) paradigm shift issues (1) level of expertise issues (8) professional development issues (1) interference with other areas (1) time issues (3) resource issues (3) ICT specialist issues (4) no concerns (1) curricular integration issues (3) expectations issues (2) creativity issues (2) teacher autonomy (2)	Technical/equipment issues (5) availability issues (5) report card issues (1) solutions to report cards issues (1) buildings' issues (2) funding issues (2) system change issues (4)
Number of codes	5	17	8
Number of respondents	7	16	9
Number of Statements	12	36	20

communication by children (Table 24, p. 168). These educators were worried that the Internet and Online communication were universal phenomena that if not dealt with properly could harm students. As mentioned by some, children were exposed to the internet outside of schools, and their lives were invaded by different forms of online communication such as electronic mails, MSN and Facebook, and as a result there was a direct impact on the life and proper functioning of today's schools. As these forms of communication were new to schools, educators believed that they required time and expertise to understand and control them intelligently. Educating children about the internet and raising awareness amongst them was sought by many educators.

Cassie (Stage 3) believed that the fast advancement of technology was still not under control in schools and the children's safety in this regard was directly at the mercy of the individual teachers' treatment of the issue. Katherine (Stage 5) shared similar views as she believed that it was the adults and schools' responsibility to teach children to use technology safely and wisely, whether it was about curriculum or safety, communication, or copy right:

> ...I can only speak with what I think about my own students and they are pretty safe, they only venture a little bit out of the box but when I go in and look at what Grade 4's are doing in another classroom, those kids will do their school assignments but on their free time, they go out of their box...we are talking e-mail and MSN and these are only nine year children and I am not comfortable with that but it won't stop so I think we have to actually teach them within the school setting about that. I don't think we can rely on the parents 100%. (Cassie, Stage 3)

However, Ron (Stage 3) raised concerns about the difficulty of developing rules and regulations with regard to teaching and safeguarding internet safety. He mentioned that despite the rules and expectations about internet use and increasing supervision in his school, they could not stop incidents related to online bullying and inappropriate use of websites. He believed that there were “many different opinions amongst teaching staff members, between the school and parents, administrators about what we should teach or shouldn’t teach, and how tight our rules need to be and what kind of supervision we should provide or not provide”, and he found it challenging to reach an agreement “on those types of things at home and at our school”.

Dale (Stage 5) believed that educators needed to continue to be proactive with regard to the use of technology and they required time to catch up on all the changes happening with the advancement of technology. He mentioned that the “underlying pieces are lack of connection with the children and students to help guide them and their moral intelligence around what they’re doing with technology.” As a principal, and a proponent of technology integration and independent internet safety presenter, he emphasized the importance of raising awareness:

> …internet safety, we don’t call it that anymore, we call it connecting with technology. The concern we have…it’s that there is not an enough of an adult presence with technology. What we find if you look at the research and you look at children is we find that children are making the rules with very little or no guidance. So if we are not a presence, the values and ethics that we want to be carried forward into the future are not going to be carried forward unless we become that presence.

Educators’ challenges

36 statements made by 16 educators in this category embodied a range of concerns and challenges that they faced on a regular basis (Table 24, p.

168). These concerns were mainly expressed as lack of time to experience with ICT integration, technical issues related to the proper use of different programs, lack of resources such as relevant software and enough computers, absence of an ICT specialist in some schools, and the need for professional development and teacher training with regard to ICT. Some examples of these statements are as follows:

> There are not too many resources out there so like if I want to do some sort of project from a computer or whatever with them like how do you teach that to them? You know because it's different knowing yourself and trying to teach it to the students. (Jeannette, Stage 0)

> I worried of course whenever the computer does not work, that's frustrating or watch a video or DVD and you can't get the hook up or someone got the other piece.... (Doris, Stage 3)

> I don't think we are getting enough help. We don't have a computer person in our school. We have one person who is fairly knowledgeable so, she is a Grade 5 teacher so we have to run to her when we have a problem.... (Beverly, Stage 0)

> How do I get the Sharepoint that I have? How do I use that successfully as the communication tool with my students and my parents because I got one but I haven't opened it up to the class yet and I am kind of scared that I was creating a monster because I need to be able to update it and use it. (Doris, Stage 3)

> ...at times, technical issues have been a barrier. In our school, it has been much better this year but in previous years, it has been a major problem. Things not working when you go into the computer lab that should....Because of mis-configuration by technicians, poor configuration, poor setup, misunderstanding of how things need to work in a teaching environment, that sort of thing, that has been a problem but not so much this year, it has been much better this year. (Ron, Stage 3)

Four educators were concerned and uncertain about the expectations for their grade level and the level of creativity that students would exhibit when involved with computers. Paul (Stage 3) shared his concern as follows: "...I guess this probably applies to most primary students, defining what the expectations should be around technology and what they should be able to do on the computer." He believed that some of the Kindergarten expectations such as maximizing students' creativity through different centres, exploring their individual capacities and reinforcing their expression were "limited on the computer to some extent right now." He argued that kids going to sites that were mainly games created by other people did not actually encourage creativity: "They manipulate some factors on the computer...not really what I would like to see in terms of the kind of creativity that I like to see them doing on a computer." Doris (Stage 3) was also unsure on how to balance creativity and the use of computers: "...it'll take up a lot of time away from more creative things like children dancing and doing art...how do I balance that...", and she felt that she required more specific information with regard to educational technology expectations for her grade level: "...how do I make sure that they are learning the skills that they need to learn and we are not just playing around with machines or technology."

The level of expertise and knowledge was another constraint that was evoking concerns amongst the respondents when integrating ICT in teaching:

> So I don't know yet, I am just starting so and I think my own sort of inexperience is concern to me because I don't know enough, so I am learning along with the kids which is OK....(Doris, Stage 3)

> From my point of view, the technology that I am using is behind what I know so I am more advanced than what I can do and so actually the technology is a constraint for me because what I want to do, I can't do because I don't have it, I feel that makes me not the norm because I would suspect that there is too much technology and people are terrified of it. (Sue, Stage 5)

Two teachers, Ron (Stage 3), a computer teacher and Katherine (Stage 5), a teacher-librarian with higher levels of ICT expertise and acting more as support teachers in their respective schools, were mostly concerned about the lack of a structure that would release time and space for teachers to work collaboratively with the expert resource teachers focussing on planning and learning, and investigating ways to integrate ICT in teaching. Katherine in particular strongly believed that one of her tasks as a teacher-librarian was helping teachers integrate ICT in their teaching, a task that was limited because of lack of collaboration time in her school:

> At the moment, it's very minimal at the elementary school. I work in an unstructured fashion with people, talking to people in the staff room... and I'll just put something together for them and put in an e-mail or something like that. It's very informal. It's not structured where we sit down and make a list...(Katherine, Stage 5)

> ...where I'm teaching to many classes in the school, there are issues always to deal with..., one area would be working with other teachers..., I enjoy doing projects with other teachers. I think those are probably the most valuable to students because it all flows together for them and it's continuous throughout the week and throughout the month, so sometimes I find it a challenge when I am working in isolation, not involving the classroom teachers but on the other hand, sometimes, that is the most easy for everyone as well because I understand the difficulty on the classroom teacher side as well that if they have not had time to bring themselves up to speed to learn the numerous things, it's just too much for them. (Ron, Stage 3)

Furthermore, Katherine (Stage 5) felt that when she had an opportunity to help teachers in the computer lab, she was actually doing all the work for them, and teachers were not as engaged as she wished. She believed "that's because they themselves have adversities toward technology and they are not fully invested" and indicated that "the attitude is...I am already overworked, how can I possibly take this on as well which is this huge, massive content so there is a lot of just not able to do it." Cassie (Stage 3) who was very involved in supporting teachers in her school disagreed that attitude was a reason to prevent teachers from not fully investing in this field as she believed that her colleagues lacked time and enough support to fully engage with integrating ICT in their teaching. This view was also shared by Chloe:

> I think the biggest issue is teacher knowledge...I can't even say age because there are older teachers who have embraced it and there are older teachers who are afraid of it and that goes with younger teachers too but my biggest concern is it moves so fast within our school district too that they can't keep up with it and also if they are supposed to learn something, when are they supposed to do it? On their own time, during school time, in-services but there is not a whole lot of in-services on ICT issues. There is a lot of committees but there is not in-services. (Cassie, Stage 3)

> Since I have come to elementary, every time we are together like professional development, for some reason they won't allow individual time. ...I just feel I can do so much more if I had the time...(Chloe)

Dale (Stage 5), the educational technology leader in this sample had a more holistic and philosophical concern and talked about the "dependability" of technology: "I believe the technology needs to be invisible. It needs to be working, it can't be the focus,...the focus is on learning and the technology is transparent."

Infrastructure

The 20 statements made by nine educators in this category targeted concerns which were related to the infrastructure aspects of technology in schools (Table 24, p. 168). These concerns ranged from the availability of ICT hardware, mostly computers to the compatibility of buildings with the use of technology as well as concerns raised by system change in elementary schools, mainly from Macs to PCs.

Ron (Stage 3) and Dale (Stage 5) who were in leadership positions were concerned about the availability and accessibility of ICT equipment in schools in general. They believed that schools did not provide all students with the equipment that was readily available beyond the walls of schools and for some in their own household. Dale believed that the district was "obviously making some good gains and trying to balance out the amount of hardware that schools receive to trust the needier schools." Kim (Stage 1) and Dan (Stage 1), two classroom teachers were more concerned about the availability of an adequate number of computers in their own classroom.

Elizabeth (Stage 0) and Doris (Stage 3) expressed frustration with regard to the old, slow and unacceptable ICT equipment available in their school. Elizabeth expressed her frustration as follows: "Well, the machines are old, I think now people are moving to high speed internet, laptops, at elementary schools, we get the leftovers, donated computers, it's very slow, very cumbersome."

One concern shared by three educators was evoked by the system change from Macs to PCs in their schools. These teachers were concerned as they were not consulted in this regard, and placed in a difficult position, which did not allow them to properly use their skills to work with programs and to fix the equipment. They had to wait for the districts' technicians to come and deal with technical issues. Overall, people who felt competent in fixing computers believed that they were frustrated by the new district policies and could not function autonomously. George (Stage 2) mentioned that teacher autonomy was affected by policies related to technology, and the money that was raised by his school PAC toward the purchase of Macs was wasted as a result of mandatory system change in his school without teachers' consultation. He expressed himself as follows:

> ...It's going to happen so we have to be sure that it's going to happen the way that we like...We have to change our practices, the way we do things because of the board's bias about some computer program...I wasn't consulted... site contacts used to be able to set up accounts for kids and put in passwords and all that, came back one summer and found that it had been taken away by an arbitrary decision by someone at the board.... How technology affects teacher autonomy, my big concern is I have autonomy to do what I want in my classroom, to teach the way I feel, not the way someone elsewhere tells me, right...

Sue (Stage 5) was also unhappy with the system change and believed that her school Mac lab "worked very well but it was the district decision." Furthermore, she was concerned with the new report card template and saw it as an issue in her teaching practice because she believed that Word was not "meant to be used as any type of reprogramming", and she explained that she brought that up at the board meeting and they said: "Oh yeah, it doesn't work on Macs..." She went further about the report cards template: "...what I proposed was that we have it on the internet and with you know log on security...do it on the internet and I even suggested being involved in getting it, I have a friend that's working on the program to do that", but her proposal was not accepted.

Furthermore, George (Stage 2) drew attention to the incompatibility of the older school buildings with the use of a larger quantity of technology equipment and explained: "This school was built 45 years ago...we had a fight over that one when we had a seismic upgrade. We said could you ask for more electricity? No... another issue for information technology...there is not an adequate energy sources."

Finally, Sara (Stage 0) who despite her effort to provide her primary students with some ICT related activities was still the least interested educator in ICT integration amongst interviewees was concerned about the money that was spent on ICT equipment in elementary schools and felt "bothered" to witness so much money spent on computers in elementary schools: "...I want to see money being spent on books...on library and so on rather than on computers perhaps, and keeping computers updated, and I just think that's a bit of bottomless pit in terms of money in elementary schools."

The personal experience of elementary educators with regard to ICT integration

Through the 242 statements that they made, the 17 elementary educators discussed their involvement and experiences with ICT and ways they used it in their practice by focussing on the following categories (Table 25, p. 178): (a) ICT equipment availability and use (b) ICT as a tool (c) Barriers to ICT use, and (d) Support for ICT use.

ICT equipment availability and use

As part of the interviews, I had the opportunity to also investigate the availability of ICT and its use by elementary educators in different schools based on their individual statements and awareness. Appendix F (p. 321) displays participants' responses in this regard. All respondents indicated that

Table 25: Codes and categories from content analysis of texts concerning the personal experiences of elementary educators with regard to ICT integration

Categories	ICT equipment availability and use	ICT use in teaching	Barriers to ICT use	Support for ICT use
Codes	equipment use (17) ICT equipment (15) laboratory accessibility (17) laboratory use (16) technical problems management (16)	ICT as mindtool (22) ICT as reading/writing tool (19) ICT as research/information tool (13) ICT as presentation tool (7) ICT as management tool (3) ICT expectations (4) Coordination with teachers (2) level of achievement (17)	accessibility (22) time/professional development (6) technical issues (5) level of expertise and knowledge (7) paradigm shift (5)	paradigm shift (3) professional development (17) resources/guidelines (9)
Number of codes	5	8	5	3
Number of respondents	17	17	17	17
Number of Statements	81	87	45	29

they were using some or all the ICT equipment purchased by their schools. The main equipment that was used by everybody was the computer. All the educators in the interview had access to a personal desktop computer in their classroom. Elementary educators exhibited a varied range of awareness and knowledge of ICT related items and their availability in their respective schools.

As for the computer laboratory, everybody had access to one in his/her school. In most of the schools, teachers were assigned two periods of forty minutes per week to use the computer laboratory. In many schools, teachers could sign up for additional blocks if available. Only in Jim's (Stage 2) school, there was no assignment of fixed laboratory blocks. Instead, teachers used the computer laboratory based on individual needs. In Dale's (Stage 5) school, the intermediate teachers had the opportunity to use the computer laboratory more than two times per week This was possible because of a higher ratio of students and computers in this school due to the one-on-one wireless writing pilot project.

As for the technical problems encountered while working with ICT equipment, almost all elementary teachers went through similar procedures as discussed in their interviews. They tried first to fix the problems by themselves, then ask the help of a more expert colleague, next ask the technology site contact to call or send a work order to the district technology department who would (based on teachers' statements) come to the school very quickly or within a couple of months. The teachers who were more experienced were to some extent unhappy and frustrated, because they were not allowed to fix the more complicated problems by themselves as per district's instruction, and had to wait for the technician to arrive:

> Well, I can't do very much because we don't have access to fixing computers. What I mean by access is we are locked out, We don't have the ability to even if we know how. All I can do is send a work order to the ICT department of the district and we are on a queue and we eventually get fixed but it's very slow, better than it used to be. Other things can be solved, sometimes it's just rebooting, turning it on or off, fiddling with the cords, you know that's about the extent of my abilities as far as what I can do. (Katherine, Stage 5)

ICT use in teaching

The amount and type of ICT use and integration in teaching varied from teacher to teacher. Overall based on the 87 statements made by the elementary educators in this category (Table 25, p. 178), ICT equipment was used as a teaching tool in the following areas: management, research/ information, mindtool and reading/writing.

When asked what is the first thing that comes to mind thinking about ICT integration, the educators all mentioned the integration of computers in their practice. Expanding on this, educators had a varied range of answers when defining integration. The following statements exemplify these opinions on what ICT integration meant to educators in this sample study:

> Eventually, you start using technology that can only be done with technology so changing images if you have a photography, you know taking pictures and the kids transform these pictures with Photoshop or some other photo you know program. (Katherine, Stage 5)

> ...the focus should be on learning not the tool. (Dale, Stage 5)

> ....using computer lab, overheads and using cameras to download things... (Beverley, Stage 0)

> ...a world of knowledge... colourful fast moving programs at our finger tips, a fast way to retrieve information without having to go to the library, sign up, take fifty books and come back, return those and go get fifty more...an easy way for kids to share with their learning because you can chat with the person beside you sitting in a computer lab little easier than the paper work and learning through desk with the textbook and a piece of paper...and easier work:...certainly easier to erase, change, fix if you are doing a project, copy paste. (Elizabeth, Stage 0)

> ...for some reasons, students learned certain concepts like multiplication better when using computers rather than flash cards...I would like it to be more than just let's go to computer lab. I wish it was used more so that we could be integrating it with art and music, drama as well as socials and science...I like to see more creativity and projects...like communicate, tell their story. (Doris, Stage 3)

> ...about kids using it as a learning tool and becoming really engaged in what they are doing. Using the internet for research, using computer programs to teach my lessons, having the kids use computers to demonstrate to me that they understand a concept...(Jim, Stage 2)

> ...using computers and technology to kind of supplement your curriculum and either use it to teach or use it for the students to have output. (Jeannette, Stage 0)

> ...integrating the use of the resources available into the classroom not in a computer lab but as part of the daily classroom schedule...the ideal...They have their pens and their papers and then they have their laptops or their computers. (Kim, Stage 1)

For others, there were still obstacles to integration of ICT such as time, resources and training that they lacked in their schools and practice. Sue's (Stage 5) comment somehow summarizes and reflects educators' opinions:

> ...for one we have far too many teachers that don't have a knowledge of the technology based on you know the fact that we missed it being kids going through so that's an issue, the capability of technology we have in society is too expensive to bring into the school system so we are not ready yet in that sense to have monies flowing into getting these technologies.

In the following sections, I describe in more detail the ways elementary educators in the sample study used ICT in their teaching.

ICT as management tool. Three elementary educators referred to ICT as a tool they used to manage their teaching tasks that would range from ordering curricular items for their work to using different computer programs to plan teaching including developing tests and assignments, and to communicate with others.

ICT as research/information tool. Thirteen elementary educators highlighted the use of ICT as a research/information tool. The appealing aspect of ICT as a research tool was evident in the interviews as Kim (Stage 1) mentioned, "the internet has a wealth of information that are not necessarily available in books or that sort of thing, so the research thing would be huge." Many teachers were more structured in their use of online resources, and were selecting specific sites to be researched by their students. Students also occasionally conducted their own research about the topic of study. Doris (Stage 3) explained that when she started using computers more to do research, she would "put quite a bookmark of website and....some questions and...research...so it'll become like WebQuest". Elizabeth (Stage 0) also used computers as a research tool: "... one of their resources had to be computers, internet site and they had to have that in their bibliography...when they went to the computer...I gave them some time to find their site they could get some facts from."

ICT as mindtool. Fifteen elementary educators indicated that they had used ICT as a mindtool, which allowed young children to engage in critical thinking (Jonassen, Carr & Yueh, 1998). Some mindtools such as databases and semantic networking were used by teachers to help students organize related information in a visual manner using screens. A couple of programs provided by the district were mainly used by teachers in this regard: Kidspiration and Kidpix. Using these programs, students were able to brainstorm and organize their ideas and data as a preliminary task for a variety of projects:

> An example that many of our teachers use well as a focus around writing, around using programs such as Kidspiration to help students to just get down their thoughts, get down their ideas around the topic or subject area, and then with Kidspiration, can then reorganize the concept map application into a much a linear flowing organization such as then their writing can be much more complete and much more effective for the reader and as they go, they've created speeches, they've created the number of these different things as well. (Dale, Stage 5)

Spreadsheets were another form of mindtools used by teachers. Overall, some teachers organized their activities in such a way that enabled their students to reflect, consider different conditions, regroup, classify, organize and make decisions:

> I do spreadsheets, they record a graphing, they recorded their spelling test results for ten weeks in a row, brought it to the computer room, entered it on a spreadsheet and then went to Graphs and it tells you do you want a bar graph, do you want a circle graph so we were able to do that and print them and then I put them up on the hall and say you know we did graphing on the computer. (Elizabeth, Stage 0)

Seven teachers experimented with ICT equipment and programs as visualization tools that would allow their students to take in information through their visual modalities:

> I went to a virtual math website at the University of Las Vegas, Nevada and I reinforced some multiplication skills and some division skills with my category Q which is learning disable children....we were working on time multiplication skills and on the computer. The students could actually visually see 3 times 4 with cubes, like they could see that, or 3 times 5 and so it reinforces skills for them. (Dan, Stage 1)

> We used it for animals in science so each group had to create, they had like an environment and they had to put the animals where they would go and what food they eat in that environment and stuff like that. They created those scenes with the Smartboard and then presented it to the class. I have used it a lot in science, so that's the Smartboard but I have used it for more stuff than that. (Jeannette, Stage 0)

Dale (Stage 5), the principal who also had some teaching assignments was using ICT as a knowledge construction tool involving students in building their own knowledge through constructing things and conversation:

> In an attempt to look at social responsibility and some of the issues around just general life issues, we decided...to involve these Webkins. So, my class has a buddy class of Grade 1/2 students. Webkins are a stuffed animal that when...you go on a specific site, you plug in their code, the animal actually becomes a virtual pet online. The Grade 1/2 students engage with the older students and with these pets and they learn to manage finances, they apply for jobs, they are involved in taking care of the pet. Recently, they've created online movies using something called Webkins studio around social responsibility issues...

One teacher had occasionally used ICT as a self-teaching tool and therefore shifting her own role as producer of knowledge to the facilitator of her students' learning:

> Instead of teaching it in the class and then going to the computer, I said you are going to teach yourself about it today, you are going to go to this site, look up volume and learn, you tell me what you'd learned when we'll go back to class and it was a very colourful and animated kind of site, and they enjoyed it learning themselves first and teaching me what they knew after. (Elizabeth, Stage 0)

ICT as reading/writing tool. Eleven elementary educators indicated that they used ICT equipment as a reading/writing tool with their students. Starting at the kindergarten level, teachers used a variety of strategies and programs to teach reading to their students and reinforce their comprehension. Chloe used Starfall, a reading program, to help her kindergarten students while

Katherine (Stage 5) used Kidpix, a child-friendly presentation program, to help with story book reading. Elementary educators also used ICT equipment for a variety of writing activities that were ranging from simple keyboarding and word processing to editing and more complex creative writing tasks.

Doris (Stage 3), a grade 4/5 teacher, explained that she followed a sequence of writing activities with her students that started with keyboarding: "We go on the computer and we type like a typewriter. Type your good copy of your story and you spell check and edit it…" She then used ICT as "creative writing kind of tool" where students took pictures, loaded them and wrote poetry based on the picture. She also used Kidspiration as an organizer for public speaking. Doris also used PowerPoint for her writing activities such as novel studies where she displayed her questions on PowerPoint, and her students had to type a summary, talk with the setting, the plot, the characters, write a letter to their author on PowerPoint: "…and then when it was done, we had a little slide show of their novel and that was actually a lot of fun."

As part of technology projects in her class, Sue (Stage 5) did an audio book. They used PowerPoint, head sets, and started with a short story including five to seven paragraphs and five to seven images: "…and they recorded what they read and an image showed on the screen, that was probably the best use of technology that we were able to get."

Some educators found the use of ICT equipment as a writing tool very beneficial for most students. Despite the fact that George (Stage 2) was critical of some political, pedagogical and financial aspects of ICT use in schools, he was very supportive of the use of word processing in writing activities. He explained that his students wrote daily in their journals for 45 minutes, and then could sign up if they wanted to publish their stories, songs or poems. George believed that this activity encouraged students to read and share their stories, "...and some of the books end up in the school library, so, without word processing, they couldn't do that, it wouldn't look very good."

Cassie (Stage 3) explained how by using ICT as a writing tool, she could help her students with learning disabilities become more engaged with the task on hand:

> Well, if a child is having problems, for example I have a child with written output and they can't write, they can't write with pencils on papers, spelling is terrible, spelling is horrible but I put the child on the computer, now, I have made templates up for them and I can put them into their files, right, from my computer, I can check their work right away. All of the sudden, with the use of technology, they don't worry about spelling, they don't worry about the ideas, they just type it all and then they self-edit and the kids know green line under the word...

<u>*ICT as presentation tool.*</u> Five teachers indicated that they used ICT as a presentation tool to reinforce learning. Some teachers used ICT to deliver their lessons but mostly they helped their students to present their projects to their classmates and share their learning with others. This could be achieved through either publishing written materials or using slides or other audio-visual means to present the content of their learning. In Dale's (Stage 5) grade 4/5 class, students worked on an anti-smoking project and could either make a pamphlet, create a website or do a PowerPoint presentation: "...they chose the means for which to represent their learning based on the resources that we had available to them, just one example." With her grade 4/5 students, Sue (Stage 5) made

notes on her laptop and showed students images or slide shows from different things she recorded on her camera.

In their use of ICT in teaching, it was evident from the interviews that almost all the elementary teachers used their own common sense and imagination to develop plans and strategies to integrate ICT in their teaching; however, it was not very clear if teachers used or required a guideline to monitor a set of specific expectations for students at each level. Their attention was mainly focused on how to use the tool to deliver the curriculum the best way they could. Ron (Stage 3), a computer teacher and learning team facilitator described the different variables that he considered when teaching different grade levels in his schools. He designed activities "…either to reinforce things…taught already in the classroom or as a way to teach something new or as a learning activity or as exploration on that topic…" In his role as a computer teacher, he mentioned that for every grade, he tried to choose a learning outcome that he would address using technology or design a project around what a teacher was teaching in the classroom. However, both Ron and Chloe, as it was previously discussed in other content areas of the interviews, found coordinating with other teachers a challenging task to overcome, which they both tried to find different ways to integrate ICT based on what was taught in each class. Ron mentioned that sometimes he met with teachers and sometimes, he just walked in their classrooms to discover what they were doing as he could not "meet with every teacher every time."

In their use of ICT in teaching, the elementary educators also expressed their opinions on the impact of ICT integration on their students' achievement. The seventeen statements made in this regard covered some similar replies to this question. Most classroom teachers based their opinions on their observations and not on a consistent qualitative assessment or quantitative evaluation and measurement of their students' achievement. As previously discussed, they all felt that students working with computer-based ICT were highly motivated and on task, and many concluded that ICT enhanced their achievements.

Two teachers, Jim (Stage 2) and Kim (Stage 2) who were still at their initial exploration stages with ICT integration believed that ICT-based teaching encouraged their students to become more engaged with the materials taught as compared to some traditional ways of teaching. Jim who had developed a transformational geometry unit as part of his learning team activities explained that it was much easier for his students to see the concepts on the computer because "they could actually see the shapes moving, flipping, turning, rotating. It would be very hard to duplicate that in class without having to actually hold up an object and turn it..." He also thought that the colourful and very interactive unit engaged the kids much more: "...I guess which essentially might improve their achievement." Kim also found the impact of a math unit that she developed during her learning team sessions significant as she felt that "...the problems were sort of brought to life and they had immediate feedback whether they had the question correct or incorrect..." She believed that this was a distinguishing characteristic of the online program: "...and that's something that I don't think I would be able to duplicate myself in the classroom..."

However, Jeannette (Stage 0) a young and new teacher and Elizabeth (Stage 0) a more experienced classroom teacher did not totally link enhanced learning for all their students to the use of ICT, and perceived ICT as just another tool that could respond to the learning needs of some of their students, and create some excitement when doing different activities. Elizabeth mentioned: "...I had children scoring A's on their science tests when we did the body systems twenty years ago and now I have some, some were C^- then, some are C^- today and they were using the computer..." She believed in order to determine the impact of ICT integration on learning, one should do the comparative study: "...you'd have to give that same unit and record the results and then give that child computer access and see it..."

Sara (Stage 0), a primary Grade 1 teacher who was the least involved and interested educator in the sample study with regard to ICT integration, felt that some ICT-based activities were meaningful and exciting to those children in her class who could read and follow directions, however, for the weaker students, the activity was quite frustrating:

> I think some of my kids are very low readers, their reading skills are still so poor that they may be looking for something and to click on and they can't find it because they can't read it so they are frustrated and so for those kids, I think it was quite frustrating to be honest because...their friends would come over and just find it, click on it, you know and they really didn't have any ownership over what was going on. Maybe for them...it wasn't very meaningful but I think for the kids who could read well enough and follow directions, I think it was definitely very positive, they were highly motivated, they loved it.

Two educators in the sample study, however felt that they had enough evidence to determine the positive impact of ICT on their students' performance. Through the programs she was using with her special education students, Cassie (Stage 3) a resource and skill development teacher believed she could monitor their progress and assess the impact of ICT integration on their learning. Furthermore, Dale (Stage 5), the principal of a school involved in a pilot testing of a one-to-one writing project felt that there were some credible evidence to support the positive impact of ICT on students' achievement in writing:

> ...the programs...provide instant feedback and so they learn their mistakes quicker and they get more practice. So in ten minutes, they probably do more work than they could do in one worksheet and enjoy the feedback of something bouncing out at them and saying good work, rather than the teacher all the time. So, yes, it has enhanced their learning. ...The programs that I have keep track of data so it tells me how they are doing on each set of assignments that they may do and it tracks their progress. (Cassie, Stage 3)

> Basically the research that we've been following is based on action research around some specific areas, some significant areas that we're seeing as engagement and achievement of boys. Connection around boys being more engaged and apt to write more and write with more details, write with more vigour in terms of using the technology...It's more teacher observation and qualitative evidence not so much quantitative evidence although we have seen positive influences in our school-wide writes which we've done using the ICT instead of you know pencil and paper and in reference to the Ministry Performance Standards around writing which is our measure, right. (Dale, Stage 5)

Barriers to ICT use

Based on their 45 statements, elementary educators identified the following barriers to ICT integration in their teaching: accessibility, technical issues, time, level of expertise and paradigm shift (Table 25, p. 178). Many of these barriers were previously addressed to various degrees by these educators mainly in the content area of concerns. In what follows, I report and describe these barriers based on the interviews, and mention those points that were not previously covered.

Accessibility was a major barrier identified in this interview. Based on statements made by 12 educators, accessibility was defined as the availability of appropriate and up-to-date resources in classrooms and in the school that would allow for meaningful integration of ICT in teaching. These resources referred to both hardware and software. The hardware usually referred to was computers, laptops and other peripherals such as cameras. The software was anything related to relevant programs and resources that would allow teachers to deliver the curriculum and enhance students' learning. Inadequate equipments and educational resources, and old equipments due to the lack of funding were all expressed by teachers as factors influencing meaningful ICT integration.

Eleven educators were concerned about the lack of enough and proper ICT-based equipment in their schools, and eight about age-appropriate educational resources. Elizabeth's (Stage 0) statement touched the issue of not just the availability of resources but the set up necessary to the safe use of the equipment in her school. She did not find the setup efficient as they did not have computer tables in the classroom. She had brought her own table from home: "...it's not safe, look at all the wires when you have 30 people in here walking around... that's a barrier, it's not a really safe setup, those machines could be pulled off the table so easily, kids tripping over cords..."

Dale (Stage 5) drew attention to the challenges that he faced as an administrator concerning accessibility issues:

> ...with having four Grade 4/5 classes in this school, having only two, have access to the laptops. It can be a contentious issue as an administrator when placing students in classrooms where parents might come in and say why doesn't my child have access to this program...so it opens up conversation for me around how we might support the child...this is where I think our society has shifted a bit too. We don't just learn at school, we learn all the time so these five hours, instructional hours at school are important but really we are learning so much more all the time so having that technology at home is supporting the child, that's a way around that.

A couple of teachers referred to the incompatibility of the older technology at school with their newer personal equipment at home as well as those more upgraded ones at school, which had an impact on the progress of their work. Five teachers brought up the funding factor as they would relate the accessibility issues to the lack of money to fund ICT equipment. Katherine (Stage 5), the librarian and technology site contact, however felt that the money was wasted and not used properly to fund technology supplies: "...we could reduce the programs that we have and use the ones we do have as opposed to having a ton of stuff and using all of it only a little bit or some of it or none of it...".She suggested to use fewer programs in schools, and only buy new ones if the previous programs were mastered by teachers: "...and then to be fair if one school is getting it, well the other school is getting it too, just to be fair, but is it really used, is it really necessary?" Katherine believed that the funding should be used wisely and one way was to support full-time teacher-librarian positions in school, which would as a result benefit the proper integration of ICT in teaching practice as she believed that the "teacher-librarian is information literacy, which is integrating technology as well as the books and the resources at the library including selecting and circulating…" She further argued that "…there is no better way to integrate technology in schools than funding libraries."

Technical issues was another barrier that was identified by nine teachers irrespective of their level of technology expertise. As Beverly (Stage 0) mentioned, "there are some things that I think make you think twice about using [computers]." Teachers felt the malfunctioning computers and inadequate support were making the task of ICT integration more frustrating for both students and teachers.

Level of expertise and knowledge. As previously discussed, the level of expertise and knowledge was both a barrier to the least and the most knowledgeable with regard to the integration of ICT in teaching. This concern was expressed by seven teachers in this category. Some educators found ICT integration challenging because of the continuous technology advancement and the more complicated aspects of technology. George (Stage 2) felt that computers were unreliable and complex: "… it seems like you have to be quite an expert to start putting things together successfully and that's a drawback, an adamant for sure…."

Time/Professional development. Seven teachers felt that they did not have the time to explore the integration of innovative technology in their practice, and as previously discussed, they all required the necessary time for professional development in this field to become more comfortable and confident in their use of ICT in teaching.

Paradigm shift. Paradigm shift was seen as a barrier to ICT integration by four educators who had a more holistic view on the integration of ICT in teaching practice. These teachers, one classroom teacher and department head; one librarian and technology site contact; one computer teacher and ICT learning team facilitator; and one principal, believed that teachers needed to change their paradigm and reflect on their pedagogical beliefs in order to feel more comfortable with the whole concept of ICT integration in their practice. Jim (Stage 2) felt that "the fear of the unknown" amongst teachers concerning ICT was the number one barrier. He explained that three years ago in his school, they did not have desktop computers and many teachers resisted to the idea: "...and in talking about it with staff, some teachers didn't want them on their desk because they felt they would take up room and they wouldn't have time to do things and they constantly checking their e-mail..." Sharing similar views and concerns, Katherine (Stage 5) believed that teachers' attitude toward ICT integration should change: "The desire, the teachers wanting to do it... teachers' attitudes need to change....In elementary, there is still a lot more resistance towards technology." Ron (Stage 3) who was personally very welcoming of change in his practice, wished for "...the school as a staff moving forward much more quickly":

> ...schools are many years behind as how they use computer to

communicate and organize as a staff...If you think about an office place now, everybody is using a shared calendar, e-mail is not an option, it's a requirement, collaborative websites are becoming mandatory... we still have printed things all over the place and it drives me crazy...it's very difficult to get people to come on board and try new things like that...

Finally, Dale (Stage 5) expressed himself as follows:

Overall, the only other barrier I can see is again around paradigm shifts, around teachers moving and seeing how examining their practice and examining how students learn best and that's a slow process but programs like the one-to-one wireless writing project, I think help break down those barriers, they provide teachers with the opportunities and the time to have those conversations to start break down those barriers a bit and shift those paradigms, so I think that's another place to always start that paradigm shift.

Support for ICT use

Based on their 45 statements, elementary educators identified the following support systems concerning ICT integration in teaching (Table 25, p. 178): professional development (ProD) and access to resources and guidelines.

Professional development. Professional development was still the most recommended solution by thirteen elementary educators as a way to be supported with regard to ICT integration. The statements made by educators covered a range of suggestions as to how the professional development would help them in this regard. Some felt that being able to work individually or with another colleague with similar technology interests would be very beneficial. Others felt that having a resource teacher at school on the staff or a resource person coming to school who could model ways to integrate ICT would be an ideal solution to become more knowledgeable and confident in this regard. Working on a one-to-one basis according to these teachers would allow them to function at their own level and design lessons based on their needs.

Beverly (Stage 0) believed that because of their very busy schedules, teachers did not tend to make the effort to do new things when left on their own. However, she thought that appropriate ProDs could provide teachers with the time they required to work on different aspects of technology such as learning to work with certain programs:

> ...so I think if you have some help and help that's at your level that it is going to make things a lot easier to use, I think I have used them a lot more...but the way it is now, I am hesitating to make that step forward and try to use the computers and things like that in my teaching.

Doris (Stage 3) suggested to have ICT literacy teachers similar to literacy teachers in schools where the ICT support teachers would go to classrooms and teach, and teachers would model after them, practice during the week until the following visit: "...similar thing where the computer person would work with your class...I want to know how to do the WebQuest...so you would see it in action but you also need a time when just the two of you can meet and go over..."

Some teachers really enjoyed the learning team format because they had the opportunity to interact with a group of teachers from their own school or other schools in the district who had similar interests and they could learn from each other. Kim (Stage 1) really enjoyed the learning team because "...it gives you a chance to also talk to colleagues about concerns you may have and compare what you are doing..."

Despite the popularity of the learning teams, Cassie (Stage 3) felt that a pronounced diversity in team members' expertise might negatively impact the dynamics of the group, and make the experience a frustrating one. She indicated that the learning team in her school was not as successful as the previous one mainly because the facilitator could not deal with the wide range of expertise. In a different school, Sara (Stage 0) did not want to participate in the learning team in her school because she did not feel confident enough, and was fearful of the intimidation factor: “No because I don’t think that I know enough to, I wouldn’t know how to contribute to the team.” Having the opportunity, she preferred to participate in a very basic workshop:

> ...like introduction, yeah, like a basic like how you turn something on, definitely, oh yeah, I would, yeah...because I don't think that I'll be looking to the person beside me to have to try to bail me out, if we are kind of all in the same situation and we are all beginners and we are all learning together so I think I will be OK with that.

Cassie (Stage 3) felt that more in-service and technology based workshops should be offered by the district: “When you go look at ProD day, there is not a whole a lot on integrating technology with the curriculum and maybe that’s something that should be put back into some of our ProD days. “ Dale (Stage 5), the principal and Ron (Stage 3), the ICT learning facilitator both believed that elementary teachers needed to shift their paradigms from being trained to self-teaching, and they required time and space for dialogue and for becoming comfortable with the concept of ICT integration and acquiring the skills necessary to become independent learners:

> I think the more we can provide, I believe that what we are doing here with our technology support teacher, maybe modelling some lessons, maybe teaching some lessons, I think helps to calm that anxiety, and allows them a comfortable situation to learn along side this particular support teacher or the children. (Dale, Stage 5)

> ...I heard this at the learning team I've facilitated, they would say, oh, we need more training on this. I personally don't agree with that because I believe that we should all be self-starters and ... that the time has far past for people should be given courses on Microsoft Word to be able to write report cards...and that's just my personal opinion but I know that some teachers would have that opinion that they should be given release time and training sessions for things like that. However, I do strongly support the learning team approach as a way to get ProD and I think it's great that some release time is given and teachers are encouraged to be self-directed and I think that is what needs to happen. (Ron, Stage 3)

Access to resources/guidelines. Eight educators indicated that they required relevant resources and guidelines as a form of support system when integrating ICT in practice. The resources referred to both hardware and software, and ICT resource person on staff. Many teachers wished for some more computers and other up-to-date ICT equipment to perform a variety of activities with their students based on their individual expertise. As Elizabeth (Stage 0) mentioned, "having a nice computer station in every classroom with good equipment, fast computers, fast internet" would be an ideal. Some other teachers were in urgent need of guidelines and lesson plans that would guide them in their teaching with technology, as well as resources that defined the age-appropriate expectations and standards for their students with regard to ICT integration.

The elementary educators' perception of the characteristics of ICT

The rate of adoption of an innovation according to Rogers (1995) depends on the characteristics of innovations as perceived by individuals such as the relative advantage of the innovation, its compatibility, complexity, trialability and observability. Furthermore, the way individuals perceive an innovation would lead to different kinds of concerns with regard to that innovation. In what follows, I discuss elementary educators' perceptions of computer-based ICT characteristics by referring to the following categories (Table 26, p. 200): (a) relative advantage (b) compatibility (c) complexity (d) trialibility and (e) observability.

Relative advantage

The relative advantage is the degree to which an innovation is perceived as advantageous (Rogers, 1995). The greater the perceived relative advantage of an innovation is, the more rapid it will be adopted. 16 elementary educators out of the seventeen interviewed believed that the computer-based integration in curriculum was indeed advantageous (Table 26, p. 200). Only one replied "Not terribly" and when she was asked to explain her response, she mentioned that she was not using the equipment enough to realize the advantages: "Well,...maybe because I don't use it enough to know the difference between whether it would be all that advantageous or not."

Based on elementary educators' statements, ICT integration in their teaching was advantageous because of the high level of students' engagement with ICT, flexibility of ICT in learning, the ease of access to information, ability to connect, and fulfilling schools' responsibility to prepare students for the future. Almost all these advantages were discussed and addressed to varying degrees by the interviewees at different sections of the interviews.

<u>Level of students' engagement</u>. As previously explained, elementary

Table 26: Codes and category from content analysis of texts concerning the perception of elementary educators with regard to computer-based ICT characteristics

Categories	Relative advantage	Compatibility	Complexity	Trialibility	Observability
Codes	affirmation of advantage (16) rejection of advantage (1) students' engagement as advantage (9) ICT flexibility as advantage (11) easy access to information as advantage (5) students' preparation as advantage (4) equity of access (1) connectivity (4) paradigm change issues as disadvantage (4) technology safety as disadvantage (5) level of expertise and support as disadvantage (8) cost and accessibility as disadvantage (6) over reliance (2)	compatibility affirmation (14) compatibility rejection (2) conditional compatibility (1) compatibility and curriculum (10) compatibility and availability (5) compatibility and education philosophy (5)	complexity acceptance (5) complexity rejection (9) conditional complexity (3) learning process and time to learn (17)	trialibility affirmation (14) trialibility rejection (2) trialibility conditional (1) trying out through ICT learning team (9) trying individually (5) trying with school colleagues (4) trying through ProD (1) funding preventing trialibility (1) lack of time/interest preventing trialibility (2)	observability acceptance (6) observability rejection (11) observability through learning team (14) observability through working with colleagues (6) observability through school/district webpage (3) observability through dialogue (3) observability through staff meeting (3) observability through ProD (2)
Number of codes	13	6	4	9	8
Number of respondents	17	17	17	17	17
Number of Statements	76	37	34	39	48

educators believed that students were highly interested, excited, motivated and engaged when working with computers. Based on teachers' statements, ICT was a motivating tool that had the ability to draw and maintain kids' attention during class time. As Cassie (Stage 3) said: "Kids like faster paced way of learning, and integrating technology with the learning keeps them interested and focused and that encourages learning."

Flexibility of ICT. Educators believed that through the use of ICT, students had different options and could learn based on their own individual needs. They believed that ICT had the advantage of meeting and adapting to a variety of learning needs from the quick learners to the most learning-disable students. In addition, ICT had the advantage of enhancing critical thinking, and promoting shared learning, and allowing people to learn better through interacting with others:

> ...incorporating the multiple intelligences because it's visual, it's audio, there is tactile, there is more flexibility in the choices kids have, in the type of products that they can make rather than just write a report... (Katherine, Stage 5)

> ...would develop the oral communication skills to a higher level...
> students who are laid in or brought down by the written world would be liberated in one sense because they could express themselves orally and not be dependent on reading or writing. (Sue, Stage 5)

> ...an incredible resource and opportunity for students to be forced to think critically and ask questions, to explore a moral intelligence...ICT empowered students to own their learning and preserved learning in general...to share their learning and to engage learning with other students around the world, not just within their own community...(Dale, Stage 5)

Easy access to information. Educators believed that ICT gave them and their students easy and instantaneous access to information that otherwise would be difficult to obtain, bringing breadth and depth to their teaching and helping with equity in accessing information:

> ...It allows you to see reality, aware through webcams and get probably many more perspectives and also it allows you to get faster information that you can never do doing books or that and immediacy, it's like right here and right now....(Chloe)

> ...it narrows the gap in terms of learning going beyond socio-economic status in that everyone has access to the same information, the same resources with respect to community programs and such so that's another big piece for our community anyway. (Dale, Stage 5)

Ability to connect. Kim (Stage 1), Katherine (Stage 5), Jill (Stage 0) and Dale (Stage 5) referred to the connectivity power of ICT as a valuable learning experience that could expand the students' horizons and enable them to connect to other local and global communities. As Katherine mentioned: "...the world is small online, like you can literally have pen pals and friends around the globe."

Students' preparation for the future was identified by elementary educators as an advantage of integrating ICT in teaching practice. These teachers believed that it was the school's responsibility to prepare students for a future in which the use of computers was a requirement in the professional world. Students needed to be skilled according to these teachers, and the development of a variety of personal and professional skills should happen in their school years. Sue (Stage 5) emphasized the importance of oral communication skills that would lead to successful carriers: "...even right down in the interview where you are orally selling yourself…" She believed that ipod was an example of "an oral tool or auditory" that could be used by teachers in the classrooms as she argued that "…the more opportunities the kids have individually to develop their oral communication skills, the better…" She believed that in a class of thirty students, using ipods would give each student the opportunity and time to work "…on their oral cue or abilities because if…they would have an audience…they would be more inclined to practice for performance." Odile (Stage 0) also referred to learning for the future: "I think now the way of the future …it's how to find your answers so students will learn how to learn by themselves and computers are a big part of that."

Despite all the advantages identified in this part of the interview, the elementary educators had also the opportunity to discuss the disadvantages of integration of ICT in their teaching. Based on their level of involvement with ICT and their knowledge and skills and interest, educators discussed different aspects related to the use of ICT that they perceived as disadvantageous such as aspects related to paradigm change, level of expertise, accessibility and cost and over reliance, which were also discussed as concerns and barriers in the previous sections of these interviews. The following sections add some new ideas to each disadvantage.

Paradigm change. One disadvantage discussed concerned all the philosophical issues that this new approach to teaching and living could bring about. Some talked about the impact of the new technology on people's relationships and the ethics that needed to be re-evaluated:

> Again, I go back to the issue around ethics and values in our society and the carrying forward of what we might perceive as right or wrong, morality is shifting because the tools are shifted so our ideals around communication or ideals around how we treat others, how we communicate authentically, I think that is something that is big picture piece but it's a foundation to the continuation of technology and use of technology in our society. (Dale, Stage 5)

Olivia (Stage 0) worried about the invasion of her privacy as a result of constant e-mail exchange with parents about every problem or homework: "...even if they e-mailed you and said my daughter's having problem with number five in math or something, could you..., you know, I would feel invaded at home, like what I feel it's not their time."

Some teachers believed that educators including some in position of leadership were still unaware or divided about the use and integration of ICT in schools. To them, that was a disadvantage, which limited the full potential of ICT integration in teaching:

> ...I mean administration, it's where is the money coming from, if it's the PAC, then there is a protocol and if the principal is behind it, then great, if the principal does not see the point of it, then probably not, so I am not saying I am limited, but I am just saying in general, the limitations would be other people's perception of how...and then the haves and have-nots ...if they were here, other teachers don't know how to use them, and what if they break and lalala so until it falls apart. And back to that, who is going to fix it or who is going to keep track of the ones that work and the ones that don't and how are we, you know, which is an issue already. (Sue, Stage 5)

Technology safety. As previously discussed in other content areas, the technology safety, especially regarding the online materials was another disadvantage discussed by some educators who believed that it was unacceptable for students to easily access "inappropriate" or "false" sites. It seemed that educators still did not have any control over the easy access to unwanted websites and there was no consensus as to how to deal with technology safety issues. One teacher, George (Stage 2) felt that the traditional library system gave them more control over the research materials explored by students.

Level of expertise. Lack of knowledge to ensure quality teaching and learning, dealing with technical issues and lack of proper support were issues also discussed in the content area of personal experiences as barriers to ICT integration. Focus on the proper use of ICT in teaching was discussed by Ron (Stage 3) who believed that one disadvantage might be "a tendency to get sidetracked with the glamour aspect of it....The flashiness and not necessarily focus on the curriculum and the learning, so. That is a bit of a risk but I think that comes with practice and experience."

Cost and accessibility: Outdated technology due to insufficient funding was again mentioned by educators in this category no matter what their level of interest was in ICT integration. They also discussed the disparity of technology access at home and at school:

> I see kids not being able to have enough and having to share equipment and as soon as you have to share, then you have to either water down your lesson or modify it...(Sue, Stage 5)

> ...Sharing of computer is not really possible. If it crashes, it's useless..., you can still read a book by the window, power goes off, there goes all the writing program... training is another one, when the technology is changing rapidly, it's hard to keep up....(George, Stage 2)

> Disadvantage, you've got socio-economic and there are kids that can not always access it, that's the disadvantage to technology...(Cassie, Stage 3)

Over reliance on technology was a disadvantage, which was identified by two teachers who emphasized the importance of hands-on activities to meet various learning needs:

> Over reliance on technology in the virtual kind of world as compared to hands on and doing concepts learning through that, I think that there is a place for computers and...there is a place for students to engage in problem solving and group work and hands on material, that kind of thing. (Paul, Stage 3)

Compatibility

Compatibility is the degree to which an innovation is perceived as being consistent with the existing applications and the potential adopters' needs in schools (Rogers, 1995). Incompatible innovations slow down the rate of their adoption by the adopters. 14 elementary educators out of 17 believed that ICT integration was compatible with what they did in their school (Table 26, p. 200). Two educators did not think that the integration was compatible at this time but they both believed that it was moving in the right direction, and they could observe more dynamics in this regard in their district. One teacher, Elizabeth (Stage 0) believed that ICT integration would be compatible if teachers had "better access to the lab". Overall, the elementary educators expressed their opinions concerning ICT integration compatibility in relation with the curriculum, ICT availability and teachers' philosophy of education through the statements they made during the interviews.

Many teachers agreed that ICT integration was compatible with the curriculum and provided them with limitless opportunities to deliver the curriculum. Ron (Stage 3) could not think about any curricular area that he would not be able to address using technology: "We have done everything from physical education, social responsibility, everything so it's compatible in that sense." Kim (Stage 1) felt that ICT was very compatible with what she was doing, especially as a French Immersion teacher: "...especially say for Immersion right, sometimes, it could be difficult to find resources so when we found the website that gave French problem solving questions, it is very compatible because it expands the resources that we have available."

Other teachers believed that the actual schools' infrastructure and schedule made the ICT integration incompatible despite their interest in integrating it in their teaching:

> ...just the physicality of how can we have the cords and pulling out the projector and asking the kids to move their desks, like this classroom is not built to have that level of technology...it is compatible philosophically with the teacher me but it's not compatible from a physical stand point. (Sue, Stage 5)

> ...it was sometimes difficult to get the computer time when you need it and for our school, that would be more difficult next year as we are growing...(Ron, Stage 3)

> ...you can't use those teachable moments when let's all go to the lab and see we could find out about that or let's take that idea and go down and do a spreadsheet on it right now and we will put it in our books...I guess to do that everybody would need computers in their classroom, take out your laptops students they are on the shelf, let's go, apparently some of the high schools they do that now. (Elizabeth, Stage 0)

The compatibility of ICT integration with teachers' philosophies of education and pedagogical beliefs was also discussed by a few teachers. These educators felt teachers needed to believe in the new approach and find time to learn about it for the integration to be successful. Dale (Stage 5) felt that the use of ICT in teaching was not compatible to what teachers did at the present time but it was “in a moving stage”: “I think we have some teachers who are constructivist in nature within our classrooms without ICT and so that shift is a lot more easier for them while others, it’s a little more difficult...”

Complexity

For the purpose of this study, complexity is the degree to which computer-based ICT is difficult to understand and use (Rogers, 1995). The degree of complexity of innovations impacts the adoption rate by adopters who need to develop new skills and understanding with regard to more complex innovations. 9 elementary educators from the 17 interviewed did not personally find ICT difficult to understand and integrate in the curriculum (Table 26, p. 200). 5 teachers found ICT difficult to manage and/or integrate. 3 teachers’ replies were conditional as they mentioned that the complexity was relative depending on what was done and sometimes, some tasks were more difficult than others.

Overall, in their discussion of the complexity of ICT integration, elementary educators expressed themselves by describing complexity in relation with the learning process and the learning curve. All the educators, irrespective of their replies and their level of comfort , believed that time was the major factor to consider when one decided to become involved with technology. They knew that they needed to spend time on their own in order to become familiar with technology and to integrate it in their teaching. Jim (Stage 2) did not think that ICT was difficult to integrate but he admitted that “...the only difficulty would be the time commitment that you have to put into learning the tool... our jobs are complex and ICT technology is just another, one of the complex things that we deal with everyday as teachers..."

As discussed in the previous sections, for some, dealing with the technical aspects was a challenge that could be magnified if the interest was not there. For others, supporting environment was a must in order to not get discouraged. George (Stage 2) expressed some concern about professional development to learn how to use ICT, and he found the technical aspects of ICT time consuming: "...the connection questions are always complicated, getting service from the technicians often takes a long long [*sic*] time so when we move a computer around our classroom, we need someone to come and fix the wiring and we go through all that..." Elizabeth (Stage 0) found computers and technology in general difficult and frustrating, especially because it was not her area of interest and therefore she was not willing to spend time working out her issues and frustration: "I only sit at the computer when I have to during the report cards three times a year...even that the district e-mail I tell people there is something important, fax me or phone me because I don't check my e-mail."

Doris (Stage 3) highlighted the importance of working with others and good leadership when it came to learning about ICT integration. She believed that people needed to have time to familiarize themselves with "a piece of equipment" and she agreed that they needed to read the manuals. However, she explained that "...some of the manuals are hard or you get lost in it, you don't know you try this function or nowhere, so it's not, for me it's not something

I would learn on my own..." She preferred to work with a group of people and supported the concept of learning teams, however she emphasized the importance of leadership within these teams: "...at one point our leader was sick and we were all sitting...can you do that, no...we were all frustrated, we had the manual, we were looking to the manual but it won't work, what are we doing wrong...."

Cassie (Stage 3) believed that with adequate support, teachers' anxiety would lessen. She felt that learning technology skills was easy, however integration of ICT in curriculum was more of "...twisting your mind and doing your subject areas and then just putting it into technology or creating something that the kids can use..." She felt that by educating teachers, the fear of ICT would disappear, however she found that this task was still challenging: "I think it's an education in teaching the teachers that..., it's not hard, I mean it is,....I think they need to do it a few times, integrate it and then they will be fine but it can be a problem."

For educators who had more interest and those who were in a position of leadership and resource, their own philosophy and attitude toward learning were motivating factors that would allow them to approach technology independently and with more ease and enthusiasm. As Dale (Stage 5) explained:

> I think teachers who are much more traditional in nature...need to be the holder of knowledge, need to be the expert, it's much more difficult, people who are more constructivist in nature or more empowering, facilitative with the children, their learning, its...much easier. For me, I am a constructivist, it is no problem...I can have an application I have never used before and I can do a lesson with children by just asking them to explore and then share with me.

Trialibility

Trialibility is the degree to which computer-based ICT in this research is experimented with on a limited basis in schools (Rogers, 1995). 14 out of 17 respondents believed that they had the opportunity to try out and experiment with integrating ICT in their teaching practice (Table 26, p. 200). Based on their statements, these opportunities ranged from participating in the ICT learning teams, trying the innovation individually by implementing the projects that they had designed or by working with a colleague in their schools. This colleague could be another interested teacher, a resource person such as teacher-librarian, a computer teacher or an assigned teacher with a high level of expertise in the school. Some of the following statements exemplify ways educators experiment with ICT integration in their schools:

> A lot of them...have engaged in learning teams which is action-research based looking at classroom practice, they can incorporate the support of the literacy support teacher or in our school's case, a technology support person to support them in what they are doing. We obviously have an excellent staff development department within our school district for which they can enquire around resources and support with the various coordinators at the different levels, elementary, middle and secondary. Once again, partner up with another teacher within the school that might have some expertise in one area that they are interested in, even access my expertise and work with myself as the administrator on something that they may be of interest. (Dale, Stage 5)

> We can try. We have buddy classes here so Ms. M.'s class and my class, we go in to the lab together, my class have logged on for her class...so we can do buddy projects together, we take just about any topic and go ...we would now get curriculum with CD's that get plugged into the lab and bingo, everybody has a game they can play. So that's really nice, it's just taking your time with them. (Doris, Stage 3)

> When I did my TLITE Pb+15 course, I designed an experiment and tried that with a small group of students and it was quite fun and the students enjoyed it and it was interesting to see the results of that. (Ron, Stage 3)

> I have because being part of pilot projects, I get time to do it and that's what you need, it's time support if you are going to try out something new so when SET BC or whoever gives me money to get a TOC to play then it all benefits the kids but if they don't give me time to play, I have no idea. (Cassie, Stage 3)

As explained by Rogers (1995), the trialibility factor will allow potential adopters such as elementary educators to experiment with integrating ICT, and reduce their uncertainty while they learn more about this new approach to teaching and learning. 13 educators in the sample study had the opportunity to participate in ICT learning teams offered by the district. Participants mentioned that the learning teams gave them the opportunity to familiarize with some aspects of educational technology during the six provided sessions, and enabled them to discover new things that they could implement in their classrooms:

> ...Our intention was to at least in my mind was to look at formative assessment and see if you couldn't do something about improving learning for students using technology...each member looked at things from a different point of view and worked on a slightly different project and different aspect of technology with students. My focus was on an electronic portfolio that a student could take home or e-mailed to a student...I focussed on one student and took pictures of his work and progress and...realized...just taking random pictures wasn't really as useful as figuring out what my learning intentions were and focusing on the outcomes and how well a student was achieving them and using the picture as evidence of that...(Paul, Stage 3)

Despite the positive outcome of learning teams as stated by most participants, Cassie (Stage 3) and Odile (Stage 0), both from the same school and with different levels of computer expertise, felt that their experience with their learning was not one that gave them the opportunity to experiment and try out new things:

...first year we had eight and that was good. Second year, we had eleven, we had a few more teachers come on board but because the knowledge was split, we had your second year people who knew more than your first year people and we couldn't split them, so it kind of fell apart because it was hard to figure out what, just hard to integrate the teaching of both so it kind fell apart. (Cassie, Stage 3)

2 teachers in the interview believed that they did not have the opportunity to try out and experiment with ICT integration in their schools. However, their replies were based on personal experiences and the limitations they felt in this regard. They were actually at the two extremes of the spectrum, for one the limitations were imposed because of her high level of expertise, and for the other, because of lack of confidence and skills.

... there is nothing that we have that would push me to do more than what I am doing, I've hit the limit of what I can do with what we have in a sense...if I try something new...it was something that I abused my own software and my own account. (Sue, Stage 5)

I haven't had necessarily myself...but our IT person was supposed to be asking us what things we wanted to do and if we wanted to try something, she was going to help us so that would have been the time when we would have able to do it, other than that, no, I haven't. (Beverly, Stage 0)

One teacher could not give an outright acceptance or rejection reply to the trialibility factor as he did not feel that all the options were open to him:

It's simply so far been my participation in the ICT learning team where I experimented with a unit online with my students and as I said for using Kidspiration as a program and implementing that but I would really like to see in the next two or three years, myself being able to have an LCD projector in my classroom and a laptop, anytime I am teaching a lesson and there is a link to a website or I want to show the kids something visually on a computer and it's right there and I can do it instantaneously....(Jim, Stage 2)

Teachers expressed themselves differently as to why they tried to experiment with ICT integration either individually or with a colleague or through

ProD workshops or learning teams. Jim (Stage 2) mentioned that he wanted to use ICT as a tool for his teaching and become a better teacher: "...it's something that I want to do every year, be well-placed in technology and it's also for my professional development, I mean down the road I want to be able to implement technology as much as I can." Doris (Stage 3) expressed her reasons for trying out ICT in her teaching as follows: "The thrill, finding out something new and also the excitement of being able to bring something new to my students."

As for some other teachers, the lack of time and interest were still factors discouraging them from becoming fully involved with ICT in their teaching. Sara (Stage 0) explained why she did not want to participate in a learning team in her school:

> I think when push comes to shove for me, there is this part of me that thinks oh it would be good if I did that but I think I'd rather do that and so I kind of you know take the path of least resistance and fall back to what's maybe more familiar or at least what's maybe more to my comfort zone.

Observability

Observability in this study is the degree to which the results of using computer-based ICT in schools were visible to others. This characteristic allows other educators to observe and discuss the results of the innovative approach and therefore make quicker decisions concerning the innovation. 11 teachers out of 17 interviewed indicated that they did not have any established structures in their schools to share and view the work of colleagues involved with ICT integration projects (Table 26, p. 200). 6 teachers mentioned that they had some forms of structure in their school where they could see the technology related work of others. The two structures were presentations in the staff meetings to witness ICT projects such as Smartboard's activities, or the school website, which included links to different class projects. Two teachers indicated that they visited the district website with links to different school projects.

No matter what the level of observability in a school was, all the learning teams' members explained that the learning team sessions were full of opportunities where colleagues could present and share their projects and receive feedback from others. There was also one final session at the district level where all the learning teams with different projects including technology could gather, and share and discuss the projects. However, as mentioned by learning team members, the sharing was only restricted to members of the teams and with the exception of the schools with a sharing structure in place, there was no opportunity for other colleagues to see the learning team projects at the school level. Dale (Stage 5), the principal believed that everyone in his school always had an opportunity to observe other technology projects and described the observability factor in his school as follows: "Fortunately in our school with our one-to-one program, I often encourage our one-to-one teachers to share what they are doing with the staff in more ways than once, sometimes at staff meetings, sometimes on ProD days, etc, learning team, presentations."

The following statements exemplify the observability factors in other schools:

> Well, the people who are really into technology here have class websites so any teacher is free to access so that's their chance, they can look at other people's sites there to see and they can go into the district site and look at what other schools are doing because it's all open to them, right

whether they choose to or not, I don't know but it's always there. (Cassie, Stage 3)

At this point, it has been limited to learning teams and just people showing what they have done, you know, during collegial moments. We don't have any sort of structure set up for example a dedicated time where people would get into grade groupings and share ICT ideas, it's a great idea but no we haven't done that at school...I think some would argue if we were given that time, we should do math or language arts.
Interviewer-Because they see things separate?
Ron (Stage 3)-Yeah.

Summary and conclusions

In order to answer the research question for the qualitative phase of the mixed methods study, "*What are elementary educators' responses (views, feelings, concerns, perceptions and experiences) toward the diffusion and integration of ICT in their practice?*", I conducted interviews to further explore the elementary school educators' views, feelings, concerns and personal experiences with regard to the diffusion and integration of ICT in schools, and to investigate their perceptions of ICT characteristics

Overall, all the elementary educators expressed similar views with many aspects of the diffusion and integration of ICT in schools. These educators were starting to notice changes in schools, society, workplaces and the world in general that they viewed as being influenced by the emerging technology. Some argued that schools were still behind concerning the meaningful integration of ICT in teaching, either due to lack of proper and up-to-date equipment or the underutilization of the already available ICT-based tools in schools. They also believed that the new generation of students was more comfortable and engaged with the new forms of technology, and although challenging for some, they mostly believed that they should integrate ICT in their teaching to prepare students for the future. However, there was some disagreement amongst teachers as to whether there was a need to integrate ICT at the primary level, with one Kindergarten teacher believing specifically that technology awareness and practice with the equipment should start at a young age, and two other primary teachers questioning the use of computers in elementary schools in general. The appropriate age to start interacting with computers is one area which is still subject to debate and research (Elkind, 1998; Healy, 1998; Alliance for Childhood, 2000; The American Academy of Pediatrics, 2000).

Educators in the study sample expressed three major types of feelings with regard to the integration of ICT in their practice. Five of these educators either had positive and proactive feelings of comfort and excitement, and welcomed any change that allowed them approach their teaching differently. Four teachers reflected reactive and negative feelings of nervousness, anxiety and frustration and lack of confidence concerning ICT integration. However, for some, these feelings were not always a sign of reluctance but mostly an indication of lack of support and guidance. Eight teachers expressed mixed feelings of both proactive and positive feelings and negative feelings with regard to the integration of ICT in teaching. It seemed that the more these teachers became involved with ICT integration, the more they felt comfortable, excited and pleased with the outcomes. However, they were also frustrated, uncertain and concerned by the limitations and the constraints that they were discovering as a result of their increasing involvement with ICT. As mentioned by Hall and Hord (1987), feelings are one of the variables that define the concept of *concern*. Overall, according to the authors, "[a]n aroused stage of personal feelings and thought about a demand as its is perceived is concern" (p. 5). Therefore, the above findings would help to analyze the concerns of the respondents in more detail in the next chapter.

Generally, with regard to the integration of ICT in practice, elementary educators identified a range of barriers: Accessibility, as defined by the lack of adequate ICT equipments and educational resources and outdated equipments; technical issues related to the use of software and hardware and lack of immediate support, time limitations, constraints caused by level of expertise and knowledge, a slow paradigm shift with regard to innovative approaches to teaching and learning. Elementary educators were also concerned with ICT safety for their students as they were generally uncertain on how to monitor students' access to internet and online communication in schools. It seemed that schools were still not in a position to develop and implement a set of rules and regulations in this regard, and even when such requirements were in place, there were still challenges and disagreements on how to implement them. It is reassuring to observe that most barriers identified by these educators are included in the list of the top ten obstacles to ICT integration reported in the IEA study (Pelgrum, 2001).

Based on the elementary educators' interviews, everybody had access to a computer lab in their school and at least one desktop computer in their individual classrooms. However, the number of times they could use the computer lab varied from one school to another, and depended on the school population and the way the computer schedule was determined. Educators had varying knowledge about the ICT equipment available to them in their schools, and it seemed the quality and number of ICT-based equipment was also varying among different schools.

Overall, ICT equipment was used by elementary educators in varying degrees of integration and as a tool in the following areas: management, research/ information, mindtool, reading/writing and reinforcement. It was interesting to find out that almost all elementary teachers used their own common sense and imagination when it came to integrating ICT in their teaching and it seemed that they did not use any guidelines to develop plans and strategies to integrate ICT when delivering the curriculum. Teachers also felt they lacked support concerning the logistics of ICT integration and there was no structured time available for them to sit with a specialist or another expert teacher in their schools including the teacher-librarian to discuss and plan ICT-based lessons. Elementary educators believed they could be better supported through appropriate professional development and better resources and guidelines. Overall, researchers have highlighted the importance of highly knowledgeable technology support personnel, appropriate professional development and teacher training concerning educational technology as well as an increased need for high quality and curriculum-relevant online contents and learnware in schools (Atkins & Vasu, 2000; Buckenmeyer & Freitas, 2005; Dean, 2001; Pelgrum, 2001, SchoolNET, 2001).

The interviews also helped me examine the perception of elementary teachers concerning the characteristics of ICT such as its relative advantage, compatibility, complexity, trialability and obersvability (Rogers, 1995). Almost all the elementary educators (16) perceived ICT integration as advantageous. A large proportion (14) perceived ICT integration as compatible with what they did at their schools. Almost half of the elementary educators (9) did not perceive ICT integration as complex and difficult to understand; among the remaining teachers, 5 found ICT difficult to understand and integrate, and 3 mentioned that the complexity was relative depending on different projects. A large proportion of educators (14) felt that they had meaningful opportunities to try out and experiment with ICT, and learn about this innovation and reduce their uncertainty, especially through learning teams. Many elementary educators (11) felt that they did not have established structures in their schools to share and view the work of other educators working with ICT. The remaining 6 educators were able to observe ICT-related work and projects during the staff meetings or through the school website. Based on Rogers, the rate of adoption of an innovation depends on the perception of its characteristics by the potential adopters. It seems that in this sample, two characteristics meaning the complexity and the observability were still areas requiring support in order to help more educators to adopt ICT integration in their practice.

In the following chapter, the findings of the quantitative and qualitative phases of this study are consolidated in order to answer the main question that guided this mixed methods study.

CHAPTER SIX
INTEGRATION AND INTERPRETATION OF QUANTITATIVE AND QUALITATIVE FINDINGS: A MIXED METHODS APPROACH

He who wants content can't find an easy chair.

-Iranian proverb

This mixed methods research study was based on the premise that the role of school educators is integral to the successful integration of educational technology in schools. The purpose of this sequential explanatory mixed methods study was to investigate the concerns of elementary educators with regard to the diffusion and integration of ICT in schools. The guiding question for this study was: *What are the concerns of elementary educators regarding the diffusion and integration of Information and Communication Technology in their practice?*

In this study, I used a two-phase, sequential explanatory mixed-methods research design to answer the major research question. In review, the quantitative survey analysis identified hypothetical Stages of Concern for elementary educators in the sample study, but it was in the details and descriptions of the views, feelings, concerns, experiences, perceptions, barriers and the requirements for support discussed in the interviews that the essence of elementary educators' concerns and needs was elaborated on and explained.

Integration and interpretation of quantitative and qualitative findings

Each of the quantitative and qualitative studies in chapters four and five has its own related discussion and conclusions. However, in a sequential explanatory mixed methods study, the quantitative and the qualitative findings are connected and talk to each other to build a negotiated account of what they mean together (Creswell, 2003; Teddlie & Tashakkori, 2003). In this study, the independent conclusions from each phase built a shared meaning together that answered the major research question. In what follows, I analyze and discuss this research study as a whole by consoliating the quantitative and qualitative findings that I obtained from four sources: the *SoCQ*, the *DIQ*, the open-ended statements in *DIQ* and the interviews. In my analysis, I attempt to determine the ways that quantitative and qualitative findings support and complement each other, and examine the emergence of new findings.

The quantitative analysis in this study determined that a large portion of elementary educators in the sample study were typical nonusers with regard to the integration of ICT in curriculum. The findings based on *SoCQ* data revealed that the responding elementary educators exhibited mostly self-oriented concerns, with a smaller group showing task-oriented concern and a few demonstrating impact-oriented concerns as evident from their highest peak-SoC.

The interviews of the volunteer educators who were purposefully selected from each SoC gave me the opportunity to focus on personal responses, and build a foundation for analyzing the relationship between teachers' Stages of Concern and their responses.

According to Hall et al. (1979), an individual's concern, which represents his/her feelings, preoccupation, thought, and consideration about a particular issue or task, is stimulated by his/her perception of this issue or task and not necessarily by the reality of the situation. Individuals' perceptions evolve from their personal make-up, knowledge, and experience, which make them intellectually deal with a given issue differently, evoking different kinds of concerns about the same issue. Therefore, concern is exhibited as the result of an "aroused state of personal feelings and thought about a demand as it is perceived" (p. 5). The purpose of this study was not to discuss the relevance of ICT integration in teaching, or otherwise question "the reality of the situation". In other words, I did not attempt to advocate or deny the importance of educational technology as part of my research. My purpose was to analyze the concerns of elementary educators with regard to this integration and in my analysis, I was interested in investigating the "feelings, preoccupation, thought, and consideration" given by elementary educators to ICT integration, and exploring how these personal attributes impact educators' Stages of Concern.

In order to accomplish my purpose and to answer my research questions, I did a three-dimensional analysis when integrating quantitative and qualitative findings. First, I did an examination of the findings across each SoC to verify the existence of a general trend at each level. Second, I did an examination of findings across all Stages of Concern to compare and contrast the general trends and characteristics of different stages. Third, in order to answer my main research question, I looked at my findings from a concern-based angle, and described and discussed the emerging concerns that were expressed by elementary educators during the interviews. All these three steps contributed to my recommendations and suggestions for further research in Chapter 7.

Examination of findings across each Stage of Concern

To integrate and examine the findings of the two phases of this study across each SoC, I regrouped the interviewed elementary educators based on their SoC (see Table 1, p. 7), and examined the relationship between their first and second SoC, their demographic background and their personal responses to the diffusion and integration of ICT in their practice. Overall, in my integrated analysis, I sought to investigate the presence of a pattern that would explain the existence or non-existence of such relationship.

In order to facilitate this examination, in the following pages I summarize the findings of this research in a number of tables specific to each category of concern where I display demographic background of the elementary educators on Stages 5, 3, 2, 1 and 0 (no respondents were on Stage 6 or 4), as well as their second highest SoC based on the analysis of the two-part survey. I also display in these tables a summary of educators' responses during the interviews including their views, feelings, concerns, perceptions and their suggested ways of being supported in regard to ICT integration in their practice. With regard to the expression of concerns, I assign two columns in these tables to elementary educators' concerns. One is labeled as major concerns, which refers to the first and immediate responses of the interviewed educators to the following questions early in the interviews: "Any concerns you have about [ICT integration]? What issues are you dealing with at this point in time?" The second column is assigned to other concerns and barriers as described by educators at later and more advanced phases where they were already fully immersed in the process and had plenty of time to reflect on other areas that concerned them with regard to ICT integration.

I have also summarized and combined Table 1 (p. 7) and Table 15 (p. 128) in Table 27 (p. 226) in this chapter for easy reference to the expression of concerns and individual behaviours that educators with different patterns of concerns exhibit with regard to innovative technology.

Collaboration concerns: Educators on Stage 5

Table 28 (p. 227) summarizes the characteristics and responses of the three Stage 5 elementary educators who were interviewed in this study: Katherine, Dale and Sue. These educators reported collaboration concerns (Table 1, p. 225), which means that they were concerned about working with other users in relation to the innovation (George et al., 2006; Hall & Hord, 1987). Overall, based on their interviews, these educators were fully supportive of ICT integration and believed in its educational benefits. They all viewed ICT integration as an educator's obligation and responsibility to prepare students for the real world, and as an educational opportunity that could engage students the most with their learning. They were all proactive and felt positive about ICT integration, and perceived themselves as leaders and resource people in this field, with Katherine feeling anxious about the underutilisation of the available ICT equipment by teachers in schools.

Table 27: Self, mixed and impact-concerns patterns and expression of concerns for each Stage of Concern (adapted from George et al., 2006; Rake & Casey, 2002)

<table>
<tr><th rowspan="2"></th><th rowspan="2">First Highest Peak</th><th colspan="3">Second Highest Peak</th></tr>
<tr><th>Self</th><th>Task</th><th>Impact</th></tr>
<tr><td rowspan="3">Expression of concerns and Individual's behavior</td><td>Self
-Little concern about or involvement with the innovation is discussed (Stage 0)
-How does this work? A general awareness of the innovation and interest in learning more about it. (Stage 1)
-How will using it affect me? What is my role in this? Individual is uncertain about the demands of the innovation, his/her adequacy to meet those demands, and his/her role with the innovation (Stage 2)</td><td>Self-Self</td><td>Self-Task</td><td>Self-Impact</td></tr>
<tr><td>Task
-How can I fit it all in? How can I master this? Attention is focussed on the processes and tasks of using the innovation and the best use of information and resources. (Stage 3)</td><td>Task-self</td><td>Task-Task</td><td>Task-Impact</td></tr>
<tr><td>Impact
-How is my use affecting my students? Attention is focussed on the innovation's impact on students in his/her immediate sphere of influence. (Stage 4)
-How can I relate what I am doing to what others are doing? How do others do this? What is the maximum potential of doing this? The focus is on coordination and cooperation with others regarding use of innovation (Stage 5)
-I have some ideas about something that would work even better. Is there a better way? The focus is on exploring more universal benefits from the innovation. (Stage 6)</td><td>Impact-self</td><td>Impact-Task</td><td>Impact-Impact</td></tr>
</table>

Table 28: Stage 5 (Collaboration) elementary educators' characteristics

Features	Educators with highest concern peak on Stage 5 (Collaboration)		
Name/ Gender	Katherine	Dale	Sue
Grade taught	Teacher-librarian	Principal-Grade 4/5	Grade 4/5
Age	30-39	40-49	40-49
Education level	Bachelor	Masters	Masters
Teaching experience	10 years	16 years	15 years
Years of computer use in teaching	> 5 years	3-5 years	3-5 years
ICT skills in teaching	13 skills	12 skills	11 skills
ICT skills for personal use	16 skills	16 skills	18 skills
Computer expertise perception	Experienced	Experienced	Experienced
Technology training in the past two years	40 hours or more	40 hours or more	40 hours or more
Type of technology-related activities	-ICT learning team -ProD (dreamweaver) -UBC teacher -librarian diploma	-Masters degree in technology and curriculum -ICT learning team -District educational technology committee -Public Presentations	-Douglas College applied IT diploma -NASA workshop -Contract work on e-learning projects -Teaching student teachers
2^{nd} highest SoC	2-Personal	2-Personal	0-Unconcerned
Views	ICT not used to full potential in schools	Students need to be engaged with the tools they are comfortable with.	Educators have an obligation to advance with technology and to see ways to integrate it.
Feelings	anxious about slow ICT implementation progress in district	positive/proactive	positive/proactive

Name	Katherine	Dale	Sue
Major Concerns	ICT safety and students preparation	Internet safety and connecting with technology	Technical issues related to the system change from Mac to PC
Other concerns and barriers to ICT integration	-Educating educators -Time allocation to structured collaboration -Old equipment	-Accessibility -Shifting educators paradigm	Technology behind level of expertise and knowledge
ICT-based teaching	-Using Kidspiration and Kidpix to teach and reinforce core subjects such as science and language arts -Presentation	Research/delicious -Presentation -Movie making -Online discussion and dialogue around safety issues	-Presentation -Audio-book -Blogging
Perception of ICT characteristics	Advantageous, trialable but not observable in my school, not complex, not compatible yet.	Advantageous, trialable and observable in my school, not complex, not compatible .	Advantageous, not trialable at my level of expertise, not observable, not complex, is compatible philosophically but not physically.

Overall, the views and feelings discussed by these educators expanded on and supported their high impact-oriented SoC, as they were fully involved with integrating ICT in their practice, and focused on coordinating and cooperating with others regarding the use of this innovation. Furthermore, the concerns profile for each of these three educators revealed lower intensity at Management and Consequence Stages, which means that these educators had innovation management and consequence under control (George et al., 2006). Based on the interviews, the way these educators used ICT in their teaching (Table 28, p. 227) revealed that they were constructivist computer-users who used ICT in exemplary fashion as described by researchers (Becker, 2000; Becker & Riel, 1994). Based on research, teachers who use computers to encourage students to present information to an audience, communicate electronically with other people and/or learn to work collaboratively are perceived as the most constructivist teachers. These teachers follow student-centred models more willingly and are more interested and willing to engage students in long projects and offer them more choice of tasks. Dale's social responsibility anti-smoking project and Sue's audio book project are good examples to justify their constructivist approach to teaching and learning.

These three educators were also fully involved with their own professional development in the field of educational technology as evident from the large number of hours of technology training they had pursued in the last two years, and the advanced technology-related activities that they were involved with (Table 28, p. 227). According to Hall et al. (1979), individuals' personal make-up, knowledge, and experience impact the ways in which they perceive and tackle different issues, and their level and kind of concerns. These educators perceived themselves as experienced computer users and used many ICT skills (Table 28) both personally and in their teaching, which based on the statistical tests of association in this study explains their Stages of Concern (Table 19, p. 137). As discussed in Chapter four, there was a positive degree of association between the Stages of Concern and the perception of expertise and number of ICT skills used by each educator.

When analyzing the highest SoC along with the second highest for these educators, I realized that they exhibited a mixed-concern pattern (Table 27, p. 226), with their highest peak at Collaborative Stage and the second highest peak for two of them, Katherine and Dale at Personal Stage and Sue at the Unconcerned Stage. In the case of Katherine, Dale and Sue with mixed concerns, their self-oriented concerns should be addressed in order for these educators to fully develop the impact-concern pattern, a pattern where both first and second highest peaks are located at the desirable impact stages during which these educators could investigate the many other possibilities of ICT in their teaching.

A closer look at the concerns profile of each teacher together with their demographic information and interviews gave some more insight into this outcome. For example, the relatively high Stage 2 in Katherine's concerns profile reflected her concerns with the incompatibility of ICT implementation procedures and her personal commitments as a teacher-librarian. In fact, during the interview, Katherine expressed concerns about not having a full-time position as a teacher-librarian, and considered potential conflicts with existing structures and her personal commitments. She felt that she did not have assigned structured time to work collaboratively with her colleagues in integrating ICT, and that her position as an information literacy teacher was not fully supported by the system. Katherine also expressed concern about the state and the underutilization of the ICT equipment in schools.

Dale, a principal with some teaching assignments at the Grade 4/5 level, was a busy individual with various responsibilities. George et al. (2006) explain that full-time administrators who have high Stage 5 concerns tend to score lower on Stage 4, which was the case for this principal. The low Stage 4 and high Stage 5 indicated that at the time of survey, Dale was mostly concerned about coordinating with others in order to integrate ICT in curriculum. This result could be justified as this principal explained during the interviews that he was leading one of the elementary schools in the District, involved in a one-to-one wireless pilot-project to reinforce student literacy skills by providing Grade 5 students with laptops. Based on his individual concerns profile, Dale also scored relatively high on Stage 2, which suggested that he was preoccupied with concerns that involved the financial or status implications of the program for himself and his colleagues. For example, during the interview, he mentioned that he was concerned about accessibility issues as he had to converse with and convince those parents who complained about not having their children placed in classes involved with one-to-one wireless writing projects. He also felt that teachers needed to have time and space to shift their paradigms with regard to ICT integration through dialogue and educational supports. Furthermore, the item analysis of his responses to *SoCQ* also indicated that he was interested in knowing how his teaching or administration was supposed to change, and in having more information about the time and energy commitments required by this innovation.

Sue, a part-time Grade 4/5 teacher, had a very intense peak score on Stage 5 (Collaboration) and very low levels of concern on other stages except for Stage 0. The low Stage 4 and high Stage 5 indicated that at the time of the survey, she was mostly concerned about coordinating with others in order to integrate ICT in the curriculum. In her interview, she revealed that although she did not formally have a resource assignment, she was considered as a resource person by her colleagues in the field of technology, which supported her high Stage 5 peak. The high Stage 0 showed that Sue was unconcerned about the innovation not because she was not interested in integrating ICT in curriculum but because based on item analysis, demographic information, and the interview, she was highly knowledgeable and very involved with other technology-related activities outside of the school, and therefore did not spend too much time thinking and worrying about the innovation (Hall et al., 1979). In fact, during the interview, Sue explained that because of her high level of expertise, she was limited in integrating ICT in her teaching the way she wished. Despite the fact that she mentioned "a passion for technology", she also explained, "...I would not suppose that people would want to spend money so that I could push myself technologically with my class." She mentioned during the interviews that she was fulfilling her technological needs outside of the school: "...because I only work part-time...I know that I can meet my technological needs in my personal life and I do..." and she explained that she was very busy with other non-related school activities such as e-learning contracts and teaching at the university level.

The integration of findings from both *SoCQ* and *DIQ* and interviews revealed a consistent pattern in terms of personal responses of these three educators on Stage 5 to the integration of ICT in their practice, and confirmed their Stage 5 Collaboration concerns. These educators' suggestions for teachers' support in integrating ICT in their teaching reflected a common philosophical stance, which was well stated by Dale the principal:

> …time, space to engage in the conversations to help them own the shift in their paradigm and only comes from time and exposure and support. I think the more we can provide, I believe that what we are doing here with our technology support teacher, maybe modelling some lessons, maybe teaching some lessons, I think helps to calm that anxiety and allows them a comfortable situation to learn along side this particular support teacher or the children.

Katherine also had some individual and more specific suggestions that reflected her school assignment. She believed that instead of hiring separate and external literacy and technology teachers, districts should rather fund libraries and support teacher-librarians as these positions combine both literacy and technology integration, and as a result, teachers would have access to immediate ICT support through onsite resource people, as opposed to literacy teachers who only visit schools on an assigned schedule.

Management concerns: Educators on Stage 3

Table 29 (p. 235) summarizes the characteristics, survey responses, and interviews of the four elementary educators, Cassie, Doris, Ron and Paul who reported management concerns (Table 27, p. 226), which means that they focused on the processes and tasks of using the innovation and the best use of information and resources. According to their survey responses, these educators were preoccupied with issues related to efficiency, organizing, managing, and scheduling ICT integration (George et al., 2006; Hall & Hord, 1987).

Overall, based on interviews, these four educators were supportive of ICT integration in teaching, and they were continuing to explore different aspects of this integration. They all viewed ICT integration as an opportunity to engage students and respond to their different needs. Two educators, Cassie and Ron were in particular comfortable with the use and integration of ICT in their teaching. These teachers' views were also related to their feelings toward ICT integration, with Cassie and Ron having positive and proactive feelings. Based on their interviews, these two educators were both their school's resource teachers in the field of educational technology and their status on Stage 3 was particularly influenced by their concerns about the lack of time in coordinating with their colleagues and lack of support for teachers to become more involved with ICT integration as well as a better ICT accessibility for all.

Doris and Paul, however, were at different levels of their exploration of the innovation. Doris expressed mixed feelings of excitement about the novelty and, "worrying away" which she argued was "in anything that happens when you learn", while for Paul, although he was a little frustrated with organizing and scheduling ICT integration, he was not apprehensive. Overall, these feelings demonstrated the proactive involvement of these teachers (to different degrees) with the innovation but also were a testimony to their preoccupation with the efficiency, organization, management and scheduling of ICT integration.

Table 29: **Stage 3 (Management) elementary educators' characteristics**

Features	**Educators with highest concern peak on Stage 3 (Management)**			
Name/Gender	**Cassie**	**Doris**	**Ron**	**Paul**
Grade taught	Student services	Grade 5	Grade 2/3, computers ICT learning team facilitator	Kindergarten
Age	40-49	40-49	40-49	50+
Education level	PB+	PB+	PB+	Masters
Teaching experience	23 years	22 years	8 years	18 years
Years of computer use in teaching	> 5 years	1-2 years	> 5 years	> 5 years
ICT skills in teaching	8 skills	3	16 skills	10 skills
ICT skills for personal use	17 skills	11	17 skills	11 skills
Computer expertise perception	Experienced	Intermediate	Experienced	Experienced
Technology training in the past two years	40 hours or more	40 hours or more	10-19 hours	10-19 hours
Type of technology-related activities	-Tools for schools -ICT learning team -Elementary Focus Computer Use Groups -District Educational Technology Committee -TAP Project -SETBC -SFU TLITE	-ICT learning team -First year SFU TLITE	-Elementary Technology Focus Group -XTA Desktop Experience Focus Group -ICT learning team -Presenter at CUEBC Conference	-ICT learning team

Name	Cassie	Doris	Ron	Paul
2nd highest SoC	1-Informational	1-Informational	4-Consequence	2-Personal
Views	ICT plays an important role in children's and schools' lives	-Views changed after taking TLITE course. -ICT responds to the needs of learning disable students.	-Extremely valuable -Very engaging tool -Responds to different learning needs	-Students need to use and practice and be aware from a young age. -Mostly uses ICT as management tool
Feelings	Positive, proactive feelings	Mixed feelings: excitement and frustration	Positive, proactive, excited	No apprehension but a little bit of frustration
Major Concerns	ICT safety	-Are students learning what they need to learn? -Lack of time -Lack of materials	No personal concerns	Guidance to integrate ICT in curriculum
Other concerns and barriers to ICT integration	-Not enough in-services for teachers -Money to replace old equipment	-level of expertise and knowledge -Technical issues	-Structured time to plan with other teachers -Up-to-date equipment -ICT safety	-Availability -Software matching to curriculum -Expectations and outcomes
ICT-based teaching	-Writing tool -Reinforcement tool -Good working tool	-Keyboarding tool -Research tool -Kidspiration for writing -Power Point Presentation	-Reinforcement tool -Learning activity tool -exploration tool -Research -Power Point	Using Kidspiration and Kidpix to reinforce learning
Perception of ICT characteristics	Advantageous, compatible, not complex, trialable and observable in my school.	Advantageous, compatible, somehow complex, trialable and not observable in my school.	Advantageous, compatible, not complex, trialable, and not observable in my school.	Advantageous, not always compatible with K, complex, trialable, not observable in my school.

Based on the interviews, the way these four educators used ICT in their teaching (Table 29, p. 235) revealed that they were also constructivist but not to the same level as elementary educators on Stage 5. Broad-based surveys (Becker, 2000; Becker & Riel, 1994) have shown that most computer-using teachers use computers to help their students to find information, explore new ideas and express themselves in writing. These objectives still support a constructivist philosophy of teaching but not to the same level as objectives implemented through electronic communication and collaborative work.

These educators were also involved with their own professional development in the field of educational technology as they were all members of ICT learning teams in their schools and participated in a range of technology-related activities (Table 29, p. 235). These educators saw themselves as experienced computer users although, Doris perceived herself as an intermediate computer-user. It also appears that they were using more of their ICT skills (Table 29) for personal use, but still using a reasonable number of skills in their teaching. Again, Doris was the exception, only using three skills in her teaching compared to 11 in personal life. However, based on interviews and her first year involvement with TLITE program, it was obvious that Doris was interested in using ICT in her teaching. The three skills reported by Doris, writing/word processing, skills mastery/drill and practice and research/internet were probably the ones she perceived as being used the most by her students at the time of the survey completion.

When analyzing the first highest SoC along with the second highest for these educators, I realized that these four educators also exhibited a mixed-concern pattern (Table 27, p. 226), with their highest peak at Management Stage and their second highest peak at the Informational Stage for Cassie and Doris, the Personal Stage Paul, and the Consequence Stage Ron. Therefore, these educators were mixed-concerns users with three exhibiting task-self patterns of concerns, and one, a task-impact pattern of concerns. The self-oriented concerns should be resolved in order to move these teachers to the impact-concern user level because unsolved and persisting personal anxiety with regard to an innovation may hold back adopters in their use of the innovation (George et al., 2006). Ron with a mixed task-impact concern pattern seemed to be ahead of the other three teachers on this stage and almost at the impact-concern stage. In fact, his personal responses during the interviews and his demographic background also supported this shift.

The integration of findings from both *SoCQ* and *DIQ* and interviews revealed some variations but still consistent patterns in terms of personal responses of these four educators on Stage.3. Therefore, it can be concluded that Cassie, Doris, Ron and Paul's Stages of Concerns were related to their thoughts, feelings, experience and perceptions of ICT integration. These educators' suggestions for teachers' support reflected some common needs that included more age-appropriate guidelines and curriculum relevant resources and options, more focussed ProD's, better accessibility, and more onsite and quick technical support.

Personal concerns: Educator on Stage 2

Table 30 (p. 240) summarizes the characteristics and responses of the two elementary educators interviewed on Stage 2 (Personal), Jim and George. who reported personal concerns (Table 29, p. 235), which means that they were uncertain about the demands of the innovation and their role and adequacy to meet these demands. They were also concerned about the potential conflicts with existing structures or personal commitment as well as the financial or status implications of the program for themselves and their colleagues (George et al., 2006; Hall & Hord, 1987).

Despite the fact that both Jim and George perceived ICT as advantageous and felt that children were excited and comfortable when using it, Jim was more supportive of it than George who viewed ICT just as a tool, and not "an end in itself". George was concerned about the cost involved and uncertain about its value at the primary level, as he mentioned: "it's not really effective use of financial resources I think at the Grade 1 level, when we are struggling for learning assistance teachers, resource room, ESL." However, Jim thought that schools were behind with their use of ICT and that children needed to get used to use ICT earlier, before they move on to higher levels." He argued that administrators needed to immerse more in technology as well to model technology use in their schools, and he wished for more active leadership in his district. He also felt that his school lacked ICT equipment, as they did not even have an LCD projector. These two views of ICT integration, although expressed somewhat differently, were still in agreement with the SoC of these

Table 30: Stage 2 (Personal) elementary educators' characteristics

Features	Educators with highest concern peak on Stage 2 (Personal)	
Name/ Gender	Jim	George
Grade taught	Grade 4/5, department head	Grade 1/2 and Music
Age	30-39	50+
Education level	Masters	PB+
Teaching experience	7 years	32 years
Years of computer use in teaching	3-5 years	> 5 years
ICT skills in teaching	10	7 skills
ICT skills for personal use	14	9 skills
Computer expertise perception	intermediate	Intermediate
Technology training in the past two years	1-9 hours	1-9 hours
Type of technology-related activities	-ICT learning team -New report card templates -New IEP templates	-ICT learning team -New report card templates -Garage Band
2nd highest SoC	3-Management	3-Management
Views	-Schools behind in their use of ICT -Children more comfortable using ICT	-Great writing tool -Very expensive
Feelings	-A little nervous because of lack of support at elementary level -Not yet comfortable	Mixed feelings: positive about advantages, concerned about cost
Major Concerns	Lack of onsite technical support	Loss of teachers' autonomy

Name	Jim	George
Other concerns and barriers to ICT integration	-Lack of time to practice -Teachers' fear of the unknown -Lack of enough technical support at the district level -Lack of enough knowledge and expertise	-Old and incompatible buildings -Lack of time -Lack of equipment -Unreliability and complexity
ICT-based teaching	-Management & research tool to prepare tests and assignments -Developing a math unit as part of ICT learning team	-Writing tool -Arithmetic practice games
Perception of ICT characteristics	ICT is advantageous, compatible, not complex but requires time to understand, trialable but not observable in my school.	ICT is advantageous, in theory, compatible, complex, trialable and observable in my school.

two teachers as they both questioned the potential conflicts of the innovation with the existing structures and the financial and status implication of ICT integration for themselves and their colleagues (George et al., 2006; Hall & Hord, 1987). This argument was also justified by the feelings expressed by these educators as they had feelings of nervousness and concern about their involvement and their role and ability to meet the demands brought on by the innovation to their practice. As Jim mentioned: "...our jobs are complex and ICT technology is just another, one of the complex things that we deal with everyday as teachers."

Based on the interviews (Table 30, p. 240), Jim and George were still not fully integrating ICT in their teaching and were exploring their options mostly at ICT learning team level, as compared to educators on Stage 5 who demonstrated more constructivist and exemplary use of ICT in their teaching, or educators on Stage 3 who were more prepared and involved with ICT use. Based on Moersch (1995), these educators used technology-based tools as a supplement to existing instructional program either as extension activities or as enrichment exercises to the instructional program.

Jim and George demonstrated a mixed-concern pattern (Table 27, p. 226), with their highest peak at Personal Stage and their second highest peak for both at Management Stage, therefore, exhibiting self-task patterns of concerns, which showed that these educators were preoccupied with the management concerns regarding ICT integration in their practice. Some of the technology-related activities undertaken by these educators were also more of management nature than teaching-oriented activities such as developing report card templates for the district. In fact, Jim, a department head in his school was appointed as a vice-principal at the end of this research project, and George a former union leader and a department head was close to retirement, as he expressed:

> We bought for the school, three LCD projectors and laptops and some wireless routers, so we're trying to get into having more teachers able to use those in the classroom, so some are starting to do that, I am not. There are basically frankly with the younger people, so they are keen to do that and I am just sort of following along since I'm retiring maybe less than two years [from now], I don't feel the need to be as up-to-date on everything.

The integration of findings from both *SoCQ* and *DIQ* and interviews revealed some level of consistency in terms of personal responses of these two educators on Stage 2. These educators' suggestions for teachers' support reflected some teacher-centred needs such as consultation with teachers and more structured professional development targeting teachers' needs early in the school year, and better accessibility.

Informational concerns: Educators on Stage 1

Table 31 (p. 244) summarizes the characteristics and responses of the two elementary educators, Dan and Kim who were interviewed in this study. These educators reported informational concerns (Table 1, p. 226), which means that they had a general idea about the innovation, and were interested in learning more about it. Stage 1 individuals generally do not seem to exhibit personal worries about themselves or in relation to integrating ICT in their practice, and are more interested in the impersonal and substantive aspects of the innovation, such as its general characteristics, effects, and requirements for use (George et al., 2006; Hall & Hord, 1987).

Expanding on these perspectives in the interviews, both educators viewed ICT integration as advantageous because of children's higher level of engagement. Kim felt that schools were behind with regard to ICT integration both in terms of quantity and quality of the equipment. Both Kim and Dan felt positive and proactive toward ICT integration in their practice. The views and feelings discussed by these educators explained and supported their peak Informational SoC, as they were demonstrating interest in learning more about general characteristics and requirements for using ICT in their teaching. For example, both teachers had become involved with an ICT learning team for the first time in their school at the time of survey, and were exploring ways to

Table 31: Stage 1 (Informational) elementary educators' characteristics

Features	Educators with highest concern peak on Stage 1 (Informational)	
Name/Gender	**Dan**	**Kim**
Grade taught	Resource teacher	Grade 2 French Immersion
Age	30-39	40-49
Education level	Bachelor	Bachelor
Teaching experience	7 years	25 years
Years of computer use in teaching	2-3 years	> 5 years
ICT skills in teaching	3 skills	6 skills
ICT skills for personal use	9 skills	13 skills
Computer expertise perception	Intermediate	Intermediate
Technology training in the past two years	1-9 hours	1-9 hours
Type of technology-related activities	ICT learning team	ICT learning team
2nd highest SoC	2-Personal	0-Unconcerned
Views	-Good idea to use ICT to reinforce students' skills -Students related to ICT -ICT is a different teacher	-Computers are integral part of life now. -Schools are behind in term of quantity and quality of ICT equipment.
Feelings	Positive/proactive	Positive/proactive
Major Concerns	Lack of resources (hardware and software)	Access and ease of access (not enough computers in classroom and not enough computer lab time)
Other concerns and barriers to ICT integration	Accessibility (not enough computers in classroom and not enough computer lab time)	-More in-service for teachers -Lack of approved curriculum-based online resources and software
ICT-based teaching	Using a virtual math website as part of the learning team with learning disable children.	Using a math unit as part of ICT learning team
Perception of ICT characteristics	ICT is advantageous, somehow compatible and complex, trialable but not observable.	ICT is advantageous, compatible, sometimes complex, trialable but not observable in my school.

integrate ICT in their teaching. These educators perceived themselves as intermediate computer users, and used a smaller number of ICT skills (Table 31, p. 244) in teaching, which based on the statistical tests of association in this study influenced their SoC.

Based on the analysis of the first highest SoC along with the second highest for these educators, Kim and Dan exhibited the self-concern pattern (Table 27, p. 226), with their highest peak at Informational Stage. The second highest peak for Kim was the Unconcerned Stage and for Dale, the Personal Stage, meaning that they demonstrated self-concern patterns. Because of their interest, proper guidance and support would help these two educators move toward higher impact-concern stages.

The integration of findings from the *SoCQ* , the *DIQ,* and the interviews revealed some consistent patterns in terms of personal responses of these two Stage 1 educators. These educators' suggestions for teachers' support reflected better and easier accessibility as well as informative workshops and training to explore and discover more ways of integrating ICT in teaching. Kim reflected:

> Well, the learning team was excellent, that was really great because it gives you a chance to also talk to colleagues about concerns you may have and compare what you are doing, so the chance to meet, you know, in a collegial fashion with your colleagues would be great and also maybe other in-servicing or access to workshops with other ideas or ways you could productively use the computer in your classroom.

Unconcerned: Educators on Stage 0

Table 32 (p. 247) summarizes the characteristics and responses of the six elementary educators on Stage 0, Beverly, Chloe, Elizabeth, Jeannette, Olivia and Sarah. Stage 0 (unconcerned) indicates their degree of interest in ICT integration at the time of the survey, but not their use or knowledge of the innovation (George et al., 2006). Therefore, based on George et al., more information is needed to determine the use or non-use and extent of knowledge of the innovation of respondents falling on this stage.

Overall, Stage 0 provides information on a respondent's degree of interest and involvement with the innovation under consideration in comparison to his interest and involvement with other initiatives, tasks and activities at the time of survey administration (George et al., 2006). As a result, a low score on Stage 0 indicates that the respondent's high priority at the time of *SoCQ* completion is the innovation in question, which has become an important part of his work and central to his thinking. A higher Stage 0 score would be indicative of the respondent's involvement with other tasks, activities or innovations, which are of greater interest to him than the innovation under study at the time of the survey.

Analysis of the interviews and the demographic data confirmed the status of these educators on Stage 0 except for Chloe, a technology and gifted teacher and teacher-librarian whose interpretation of integrated data was not consistent with other teachers in this category. As evident from her profile analysis, Chloe seemed to exhibit many different intense peaks: a high Stage 0 (Unconcerned) with almost tied high Stages 2 (Personal) and 3 (Management). The relative position of Stage 1 and 2 was in agreement with *Negative one-two split profile* indicating that this teacher was concerned about personal impact of ICT

Table 32: Stage 0 (Unconcerned) elementary educators' characteristics

Features	**Educators with highest concern peak on Stage 0 (Unconcerned)**					
Name/Gender	**Beverly**	**Chloe**	**Elizabeth**	**Jeannette**	**Olivia**	**Sara**
Grade taught	Grade 3	Library/Gifted/ Computer	Grade 5	Grade 3	Grade 2/3 French Immersion	Grade 1/ 2
Age	50+	40-49	50+	20-29	50+	50+
Education level	Bachelor	Masters	Bachelor	Bachelor	Bachelor	Bachelor
Teaching experience	20 years	16 years	30 years	2 years	25 years	15 years
Years of computer use in teaching	3-5 years	3-5 years	>5 years	2-3 years	>5 years	>5 years
ICT skills in teaching	4 skills	15 skills	3 skills	8 skills	5 skills	3 skills
ICT skills for personal use	6 skills	10 skills	2 skills	9 skills	8 skills	6 skills
Computer expertise perception	Novice	Intermediate	Novice	Intermediate	Intermediate	Novice
Technology training in the past two years	1-9 hours	10-19 hours	1-9 hours	1-9 hours	1-9 hours	None
Type of technology-related activities	-ICT learning team -Kispiration	-ICT learning teams -Kidspiration/ Smartboard -Elementary computer group	ICT learning team	-Smartboard workshop -UBC ICT courses	ICT learning team last year, but quit this year	N/A

Name	Beverly	Chloe	Elizabeth	Jeannette	Olivia	Sara
2nd highest SoC	2-Personal	2-Personal 3-Management	3-Management	2-Personal	3-Management	1-Informational
Views	-Need to learn how to use ICT. -Need more in-service. -Are not using our computer room as much. -Some kids are better at writing at computers	I think it's an exciting thing to bring into the classroom and kids really like it but I don't think it can replace a good teacher.	-We need to move forward with the kids although I am feeling left behind. -ICT should be used with other resources. -I use the computer for report cards only because I have to.	-Good to bring ICT in because children are a lot more exposed to it now and comfortable with it. -Frustrating especially when it crashes.	-It is a tool that should be integrated in all subjects. -It is important that students learn all different applications such All The Right Type.	-I wish I knew more to do more with my kids. -Never something that interested me a lot. -I don't know I wish for that enough to really go to the ends to make that big change. -I don't know if it is going to make me a better teacher.
Feelings	Nervous and not confident	Apprehensive and proactive	Mixed feelings: pleased and happy, and frustrated	Mixed feelings: positive and frustrated	-A little intimidated by all the new things -A little hesitant about learning something new -Overloaded and invaded by e-mails	Uncertain

Name	Beverly	Chloe	Elizabeth	Jeannette	Olivia	Sara
Major Concerns	-Lack of overall support	Time for individual professional development -System change to PC	-Old equipment -Lack of onsite technical person -Meaningful ICT integration	-Lack of expertise to deal with technical issues	-Lack of knowledge and expertise -No interest in learning new things on own.	-Cost: In K-5, money should be spent in other areas -Frustrated with report cards
Other concerns and barriers to ICT integration	-Lack of knowledge to use the available programs -Lack of ICT support people on staff	-Technical support -Incompatibility of school and home programs -Immediate support	-No ICT resource person; No proper and safe ICT setups Lack of knowledge and expertise -Lack of in-service	-Lack of guidelines/ resources as how to integrate ICT and curriculum	-Being behind -Technical issues -Lack of time to prepare lessons	Lack of expertise to operate or use something.
ICT-based teaching	-Research -Kidspiration	-K: Starfall reading program -Grade 1: Logging, Kidspiration, Kidpix Grade 2: Kidspiration, Word Grade 3, 4, 5: All the right type, PowerPoint, Spreadsheet, Database,	-Research -Self-teaching and teaching to others -Spreadsheet	-Research -Word processing -All the right type -Kidspiration	-Using Smartboard to teach math and science -Power Point Presentation -Research	-With the help of teacher-librarian, I used Kidspiration to teach science. -Basics to access computers/internet /word processing
Perception of ICT characteristics	Advantageous Compatible, Complex, Somehow Trialable but not observable	Advantageous, Compatible, Not complex, Trialable, Observable	Advantageous, Not very compatible, Complex, Somehow trialable, Not observable.	Advantageous Compatible, Not so complex, Trialable, Observable	Advantageous, Compatible, Not so complex, Trialable, Observable	Not advantageous, Somehow compatible, Complex, Somehow trialable, Not observable

integration. The item analysis of her data seemed to indicate that she was interested in the innovation but at the same time extremely busy and concerned with other duties. When I interviewed Chloe, I was convinced that she was very involved with ICT integration in her teaching but she was also complaining about her time constraints and her other responsibilities. As a part-time teacher and mother of young children, she felt that she was spending all her time at school even on her days off. She also mentioned that she completed the questionnaire within a three-day timeframe with frequent interruptions, after coming back from a long weekend treat. Based on George et al., this way of completing the *SoCQ* may jeopardize the final results, which may be the case for Chloe's results. In the following sections, I highlight the inconsistency of Chloe's results while I show the consistent pattern of the other five teachers' responses with regard to Stage 0.

The interviews confirmed the Stages of Concern for Beverly, Elizabeth, Jeannette, Olivia and Sarah. For example, based on the *SoCQ* data interpretation of the individual concerns profile of the five educators, Sara was identified as an *Unconcerned Innovation User* who is defined in the *SoCQ* guideline as a teacher who lacks interest and/or time to become involved with ICT integration in curriculum (George et al., 2006). Sara's interview confirmed her status, as she publicly acknowledged that technology "has never been something that's interested [her] all that much", and she felt that she was not trying hard to learn more about it, and whatever she did with the students technology-wise was with the help of others and for the sake of the students.

Based on the *SoCQ* guideline (George et al., 2006), the individual concerns profiles of the other four teachers was in agreement with Typical *Nonusers* who were not fully engaged with the innovation because of other interests and/or commitments but might have some general awareness of the innovation or be impacted by its personal aspects. In fact, the term nonuser only indicated that these teachers were not fully engaged with the innovation for a variety of reasons, but did not claim that they had not started exploring it.

Checking the amount of technology training in the past two years (Table 32, p. 247), with the exception of Sara who reported no training, the other four had only received 1-9 hours of training, and they all reported using smaller numbers of ICT skills ranging from 3 to 8 in their teaching. However, Chloe had received 10-19 hours of technology training in the past two years, similar to some of the educators on Stage 3 (Table 29, p. 235). Despite the fact that some of these educators were involved with ICT learning teams, the interviews revealed that only Chloe completed her sessions. For example, Elizabeth completed three sessions during school time for which she was provided a teacher-on-call, but she did not attend the other three sessions that happened outside of school hours or at lunch time. At one point in the interview, she mentioned:

> I don't have the knowledge to teach the kids how to do a PowerPoint presentation, I don't have the background and knowledge and we are not given the training as a teacher within the school system, unless you want to sign in for courses yourself and at this stage in my carrier after 30 years of teaching, I am not going to spend my week-end up at SFU learning about computer technology or my nights. So unless they are going to address that problem in school, I just do what I can.

Olivia explained her reason for quitting the ICT learning team as follows:

> I did start off on the technology learning team but because it was too much for me, like because I was on that French Learning team and I was also going to the Math Makes Sense workshops, I let it go and also because I didn't find it that helpful this time. I was on technology learning team last year, which was more helpful, this year, I didn't feel it was as helpful as it was last year...

In the case of Chloe, however, she was involved in two learning teams in the past two years, one on Kidspiration and another one on Smartboard that she was implementing in her school with another colleague, which she enjoyed very much. She was also part of a more advanced group in the district, the Elementary Computer User Focus Group where she was working with other district colleagues with similar interests on developing lesson plans for their classes. This more advanced involvement with technology by Chloe was another indication that she did not belong to Stage 0.

All six educators exhibited both self-concern and mixed-concern patterns (Table 27, p. 226), with their highest peak at Unconcerned Stage and the second highest peak, the Informational Stage for Sara; the Personal Stage for Beverly and Jeannette, and the Management Stage for Elizabeth and Olivia. Again, Chloe presented a different pattern as she had a tied second peak of both Stages 2 (Personal) and 3 (Management). Overall, the self and task-oriented concerns should be resolved in order to move these teachers to the impact-concern user level.

The integration of findings from the *SoCQ,* the *DIQ,* and the interviews revealed some consistent patterns in terms of personal responses of five educators including Beverly, Elizabeth, Jeannette, Olivia and Sara, on Stage 0.

However, Chloe's responses were an exception to this pattern, which was justified by her interviews and background as she explained how she completed the survey inconsistently. Treating Chloe as an outlier and removing her from the quantitative statistical analysis will not affect the conclusions—given that she belonged to the Stage 0, which already had a large number of respondents (33 out of 60) (Table 14, p. 126). For example, the χ^2 value for testing the relationship of gender and Stages of Concern will change from 5.77 to 5.56 with the threshold value of 9.49, which does not affect the conclusion (Table 19, p. 137). As for the qualitative phase of the study, Chloe's responses were treated similar to other respondents as the purpose of the second phase was to present a descriptive qualitative report of the educators' responses with regard to ICT integration in their teaching.

Finally, Stage 0 educators' suggestions for teachers' support reflected their own specific needs with ICT integration. Elizabeth was interested in a high-quality computer station in her room. Overall, these educators were mostly interested in modular support meaning workshops and trainings that were designed to target their individual specific needs at their own level. They were also interested in a library of relevant programs, resources and step by step guidelines that would help in prepraring to integrate ICT in their teaching. Here is how Olivia expressed herself in this regard:

> I think if there were some prepared lessons like a binder of prepared lessons, of things that would help the teachers be better prepared to teach because we have the big screen, we have the projector, we could be doing it on our own, and like following easy steps, you know Ok, now everybody do this and everybody do that. I think that would be very helpful

> for somebody like me and for other teachers at the school who aren't totally you know familiar with everything that computers can do.

Overall, the integration and interpretation of the quantitative and qualitative findings not only confirmed a consistent pattern of association between the Stages of Concern and personal responses to ICT integration in teaching, but it also reinforced the reliability and validity of the *SoCQ*. Since its origin in 1979 (Hall et al., 1979), this questionnaire has been largely used by researchers interested in concern studies.

Examinations of findings across all Stages of Concern

In the second phase of my examination, I looked at the findings across all Stages of Concern to compare and contrast the general trends and characteristics that I explored during the first phase of my examination within each SoC. To do so, I compiled educators' main messages with regard to their views, feelings, experiences, perceptions and concerns that were gathered in Table 28 (p. 227) to Table 32 (p. 247) in another table across their SoC to facilitate my review and examination. By referring to this table and by going back to the body of the interviews and my qualitative analysis, I completed my cross-examination of all Stages of Concern, as presented in the following sections.

Views

The varied thoughts and considerations of individuals about a given task or issue has been defined as one of the key factors leading to different kinds of concern about that issue (Hall et al., 1979). Therefore, examining elementary educators' thoughts and views about ICT integration in their practice would give some insights into the type of concerns they would develop regarding this innovation. Overall, it seemed that all educators irrespective of their Stages of Concern believed (in varying degrees) in the important role ICT plays in today's world and its impact on schools. However, educators on Stages 5 and 3 supported the integration of ICT in schools with no hesitation, and rarely made a remark against the benefits of learning through technology. Within the *View* category, these educators' focus was mainly on students and their learning as they discussed the high level of students' engagement and comfort with technology, which could adapt to different learning needs of students. Many of these views such as the importance of ICT and students' engagement were also shared by educators on Stage 1 who were enthusiastic about learning more about ICT but were still at an earlier SoC. This lends itself to the assumption that these teachers are very good candidates to move toward higher SoC if they receive proper support.

Mixed views about ICT integration in teaching were more evident among educators on Stages 2 and 0, who despite their positive statements about ICT, expressed more frustration with regard to the lack of knowledge, expertise, in-service and technical issues. Since many educators in the sample study fell on Stage 0, special consideration should be given to them in order to help them move to a higher SoC.

Feelings

Individuals' feelings about a particular issue has been considered as another factor that triggers different kinds of concerns in individuals about that issue (Hall et al, 1979). The only SoC where there was any expression of pure positive/proactive feelings concerning ICT integration were Stages 5, 3 and 1. On Stage 5, two educators out of three were positive, the other one was anxious about slow ICT implementation progress in District. On Stage 3, two educators (out of 4 only) had only positive/proactive feelings, while another had mixed feelings of excitement and frustration due to the benefits of technology and the anxiety related to learning new things: “worrying away which I suppose it's in anything that happens when you learn”. The fourth teacher had no apprehension but expressed frustration due to obstacles such as lack of relevant materials.

No educators on Stages 2 and 0 expressed pure positive/proactive feelings as almost everybody had negative feelings of nervousness, hesitation, uncertainty, intimidation and being overwhelmed. Two teachers, one on Stage 2 and two on Stage 0 expressed mixed feelings of interest in some of ICT advantages but frustration and concerns about cost and other ICT-related issues. As discussed in the previous sections, these feelings justify the status of these individuals in their respective Stages of Concern. A characteristic that would help with further recommendations to support teachers with personal concerns.

Personal experiences

Research was by far the most expressed ICT-related task that was discussed by educators on all Stages of Concern in this category. It was evident from the statements that access to Internet opened a wealth of information to these educators, which was also expressed as an overwhelming task mostly by educators on the early Stages 0, 1, and 2 who perceived the task of locating appropriate educational websites challenging.

As previously explained in the cross examination of each SoC, based on the type of ICT-based activities performed by educators, it was concluded that educators on Stages 5 and 3 had a constructivist approach to their use of ICT in teaching with Stage 5 teachers being more constructivist than Stage 3 teachers as they involved their students more in activities that included communicating electronically with other people and/or learning to work collaboratively. Teachers on other Stages 0, 1, and 2 in general were all in the exploration phase using isolated ICT-based activities to supplement and/or enrich their teaching. According to Moersch (1995), the ideal use of ICT in teaching happens when:

> Technology is perceived as a process, product (e.g., invention, patent, new software design), and tool to help students solve authentic problems related to an identified real-world problem or issue. Technology, in this context, provides a seamless medium for information queries, problem solving, and/or product development. Students have ready access to and a complete understanding of a vast array of technology-based tools. (p. 42)

Perceptions

Table 33 (p. 258) summarizes elementary educators' perceptions of ICT characteristics (Please note that Chloe results are not included in this table as her SoC was inconclusive). Teachers' perceptions about ICT integration based on Rogers (1995) and Hall et al. (1979) have a significant impact on their type of concerns and the rate of ICT adoption in teaching. As it can be seen from the data provided by Table 33, almost everybody perceived ICT integration as advantageous.

Table 33: Statistics of elementary educators perceptions of ICT characteristics

ICT characteristics	Stage 5 (3)		Stage 3 (4)		Stage 2 (2)		Stage 1 (2)		Stage 0 (6)	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Relative advantage	3	0	4	0	2	0	2	0	4	1
Compatibility	0	2 Y 1*	2 Y	2*	1	1*	1	1*	4	1*
Complexity	0	3	1 Y 1#	2	1 1#	0	1#	1	3	2
Trialibility	2	1	4	0	2	0	2	0	5	0
Observability	1	2	1	3	1	1	0	2	2	3

*somehow compatible, not always compatible, in theory compatible but not physically.
#somehow complex

As for compatibility, the responses were quite different. Educators on Stage 5 who were the most involved with technology did not perceive ICT integration as compatible with the present state of teaching although one felt that it was moving in that direction. These educators felt that despite the fact that ICT in general was compatible with teaching, at the present time, many factors such as the accessibility and physical settings were limiting this task. This perception reflects the broader knowledge and involvement of these teachers with ICT, therefore a better awareness of the real circumstances surrounding it. At the other extreme, 4 educators out of 6 on Stage 0 found ICT integration compatible with what they were doing. As for educators on Stages 3, 2 and 1, the perception was equally shared between those who perceived it as compatible and those who did not. Compatibility is a perceived characteristic of an innovation (Rogers, 1995), which impacts the rate of adoption.

As for the complexity, none of the educators on Stage 5 found ICT integration complex. In fact, all these educators were self-teaching and welcoming of the change and the challenge. Beginning with Stage 3, teachers expressed more varying degrees of challenge when integrating ICT in teaching.

As for trialability, almost all educators no matter what their SoC, perceived ICT integration as trialable. Only one educator on Stage 5 felt that her high level of expertise could not be met with what was available in her school. Eleven educators perceived ICT work by teachers not observable in their school and 5 had sharing sessions in their school. One interesting project would be to investigate the SoC of respondents based on the observability factor in their school. The smaller number of participants in the interview would not allow a thorough discussion of this characteristic.

Concerns

Overall, many educators from all SoC referred to *accessibility* and *technical issues* as majors concerns. ICT safety and lack of structured collaborative time were the two concerns that were specifically expressed by educators on Stages 5 and 3. The other concerns were expressed in varying degrees by educators on all stages (Table 34, p. 262). Educators' concerns are discussed in more detail in the following section, which aims at answering the major research question guiding this study.

Elementary educators' concerns with the diffusion of ICT in schools

Based on the integrated findings in this research study, I summarized the concerns of elementary educators with regard to ICT integration in their practice along with their suggestions for support of this integration in Table 34 (p. 262). Furthermore, the written responses of the 11 respondents to the open- ended question of the *DIQ* regrouped their concerns into five major categories: concerns related to time constraint, concerns related to proper technology equipment, concerns related to lack of information and/or proper technology training, concerns related to ICT literacy and integration, and concerns related to onsite technology specialists. By integrating these five categories and the content of Table 34, I identified the major emerging concerns of elementary educators that I display in Figure 4 (p. 264).

To answer the major guiding research question in this study, *What are the concerns of elementary educators regarding the diffusion and integration of Information and Communication Technology in their practice?*, I refer to Figure 4 and I describe the four categories of concerns as follows:

- Concerns related to the philosophy of education and pedagogy including issues related to the teaching and learning philosophies of educators in general with regard to ICT integration, the autonomy of teachers with regard to ICT implementation policies, and the role of leadership in the process of ICT implementation,
- Concerns related to accessibility that include concerns with regard to the accessibility of hardware, software and resource people,
- Concerns related to the technical infrastructure support including technical issues and incompatible buildings and lack of proper setups for ICT equipment,

- Concerns related to educational technology integration including issues related to ICT safety, level of educators' expertise and knowledge, time for coordination with others and professional development, and integrated curriculum and age-appropriate ICT expectations.

Concerns related to the philosophy of education and pedagogy

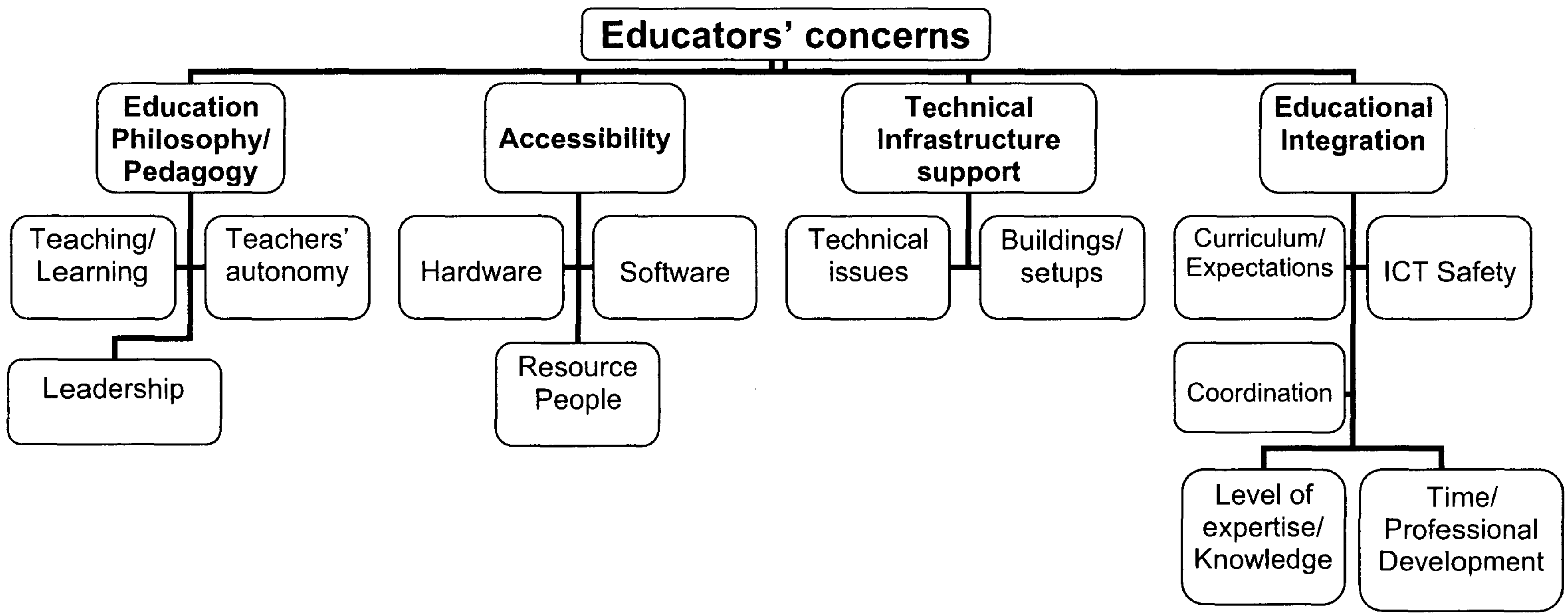
The integration of ICT in teaching and innovative educational technology approaches raised some debates around the educators' philosophy of education and pedagogy, teachers' autonomy and the role of leadership during interviews. The educators most involved with ICT in this research seemed to be the most constructivist as well, a finding that is supported by research (Becker, 2000; Becker & Riel, 1994). These educators were also the most concerned about what some called the necessity for a paradigm shift in teachers' thinking about learning, if teachers are ultimately to integrate ICT in their practice. It has been found that teachers' beliefs, teaching philosophies and goals have an impact on the successful implementation of ICT in schools (Becker, 1994; Becker & Riel, 2000; Granger et al., 2002). In order to support teachers in integrating technology in their practice, various forms of pedagogy and interactive learning dimensions (Reeves and Reeves, 1997) that teachers can use in their practice need to be embedded and modelled in professional development programs which promote integration of ICT into teaching (Carlson & Gadio, 2005). In order to promote lifelong learning, and improve and transform teaching and learning, isolated

Table 34: Summary of elementary educators' concerns and suggestions for support based on their Stages of Concern

Stage-related Concerns	Major concerns	Other concerns and barriers	Suggestions for support by elementary educators
Collaboration concerns	-ICT safety and connecting with technology	-Shifting educators' paradigm through educators' education -Lack of structured collaboration time -Accessibility issues and old equipment -Technology behind expert teachers' level of expertise and knowledge	-Helping teachers to own their paradigm shift by providing time and space to learn, practice and engage in dialogues -Funding libraries and teacher-librarians
Management concerns	-ICT safety -Unclear expectations and outcomes and lack of guidelines -Lack of time and materials	-Lack of in-services and structured collaborative time -Availability issues: hardware/curriculum-relevant software -Lack of up-to-date equipment -Technical issues -Level of expertise and knowledge	-Provision of more focussed ProD and onsite support for ICT integration -Provision of better accessibility -Provision of more onsite and quick technical support
Personal concerns	-Lack of onsite technical support -Loss of teachers' autonomy	-Teachers' fear of the unknown -Lack of enough technical support at the district level -Lack of knowledge and expertise -Unreliability and complexity -Lack of time to practice -Lack of equipment and old equipment -Incompatible buildings	-Provision of more structured and modular needs-related professional development -Consultation with teachers

Stage-related Concerns	**Major concerns**	**Other concerns and barriers**	**Suggestions for support by elementary educators**
Informational concerns	-Lack of resources (hardware and software) -Access and ease of access (not enough computers in classroom and not enough computer lab time)	-More in-service for teachers -Lack of approved curriculum-based online resources and software	-Provision of better and easier access -Provision of informative workshops and training to explore and discover more ways of integrating ICT in teaching
Unconcerned concerns	-Old equipment -Lack of onsite technical person -Lack of knowledge and expertise to integrate ICT -Lack of guidelines and resources to meaningfully integrate ICT and curriculum -Lack of expertise to deal with technical issues -Lack of interest in learning new things on own. -Cost: In K-5, money should be spent in other areas -Frustration when doing report cards	-Lack of ICT resource person -Lack of proper and safe ICT set ups -Lack of in-service -Lack of time to prepare lessons -Being behind and overall lack of expertise to operate or use technology	-Provision of high quality equipment to elementary schools -Modular level-related workshops and trainings -Provision of libraries of relevant programs, guidelines and resources to lead and support ICT integration

Figure 4: The concerns of elementary educators with the diffusion of ICT in schools



Workshops and training sessions should be replaced with lifelong professional preparedness and development of teachers (Haddad, 2000). As Dale the principal mentioned:

> Overall, the only other barrier I can see is again around paradigm shifts, around teachers moving and seeing how examining their practice and examining how students learn best, and that's a slow process .... I think they are holding a paradigm where they need to be the expert, and when they can let go of the facts that they don't need to be the expert, the children are the experts, they are the facilitator of learning, I think they can move past that, that holds them back, sometimes, it's a humility issue...I believe with technology...because knowledge is changing so fast, information, access to so much information, so we need to set aside our ideals of being the expert, that we're the holder of knowledge, and empower children to own their own learning.

A few teachers were also concerned about the loss of teachers' autonomy as they believed that the district made decisions with regard to ICT diffusion without consulting them. For example, changing the computer system from Mac to PC was a major concern to some teachers who felt that they were limited in their abilities to use and fix the new equipment.

Concerns related to accessibility

Issues related to accessibility were a common concern among the majority of participants in this study. These educators were concerned about the lack of adequate up-to-date hardware and relevant curriculum-related software. Many teachers also believed that they did not have access to an onsite resource person with ICT integration expertise and knowledge in their school. Based on international surveys (Pelgrum, 2001), inadequacy of hardware was reported as an obstacle to ICT-related efforts by many educators even those respondents working under very favourable conditions, such as in Canada with an estimated median of 5 students per computer (Plante & Beattie, 2004). The lack of enough software and curriculum-relevant online content was also reported among the top barriers to ICT integration at the national and international level (Pelgrum, 2001, SchoolNet, 2001). Furthermore, highly knowledgeable support personnel who could help teachers integrate ICT in their teaching has been reported as an important factor that would allow the sustainability of the quality use of ICT equipment in schools (Pelgrum, Plante & Beattie).

Concerns related to technical infrastructure support

Technical issues related to ICT equipment, such as equipment speed, computers and/or smartboards crashing in the middle of lessons, and a lack of technical support to fix problems were reported as a major concern by almost all the elementary educators in the sample study. There were also teachers who complained about the incompatibility of school buildings and physical arrangement of classrooms with the new ICT equipment. They also had concerns about proper set-ups for computers in the classrooms or lack of wireless environments. Plante and Beattie (2004) noted that computers in Canadian schools were aging, and only 23% of elementary schools in Canada had computers operating with the most up-to-date systems. It was also reported that an average of 11 minutes per computer per month was spent on ICT maintenance and technical support in Canadian schools with low processor speed computers. Lack of technical support was also reported as one of the top ten obstacles to ICT integration at the international level (Pelgrum, 2001).

Concerns related to educational integration

To different degrees, the elementary educators in this study shared concerns related to educational integration of ICT in teaching. Those in the self-oriented categories were more concerned about the lack of age-related expectations with regard to ICT standards of teaching, and required ease of access to appropriate and relevant guidelines as well as information on ways to meaningfully integrate ICT in their teaching. They were also in need of curriculum-relevant resources that they could incorporate in their teaching. The necessity for high quality curriculum-relevant online content and learnware that can be easily used by students and teachers has also been emphasized in SchoolNet reports (http://www.schoolnet.ca/snab/e/reports/snab _reports.asp). Those educators at the highest Stages of Concern were more concerned about ICT safety and a lack of set structures to monitor and supervise students' access to the internet, as well as a lack of structured collaborative time to plan and develop ICT-based lessons with their colleagues.

Overall, the level of expertise and knowledge with regard to ICT integration was observed as a constraint by many educators no matter their Stages of Concern. The most expert users felt that schools could not provide them with enough opportunities to fully integrate ICT in their teaching, while the other respondents felt that their extent of knowledge and expertise was a limitation to their use of ICT in their teaching. International research has identified teachers' lack of knowledge/skills as one of the ten obstacles to ICT integration (Pelgrum, 2001). Thirteen educators out of seventeen in the study sample perceived professional development, including proper in-services and time to practice, as the best ways to prepare for the meaningful integration of ICT in their teaching. At the international level, the difficulty of integrating ICT in instruction and insufficient teacher time were reported in the top ten obstacles to ICT integration (Pelgrum, 2001).

Summary and conclusions

In this chapter, I integrated and analyzed the findings of both the quantitative and qualitative phases of this mixed methods study to answer the main research question, and to identify the concerns of the participating elementary educators with regard to diffusion and integration of ICT in their practice.

I proceeded with my analysis by examining the findings within each SoC followed by an examination across all Stages of Concern. Overall, in my analysis, I concluded that the qualitative findings obtained from the interviews confirmed the Stages of Concern of the participating elementary educators in the survey, and highlighted the strength of *SoCQ* as a valid and reliable tool. It was evident from this cross-examination that members of each SoC shared some common characteristics supporting their level of concerns.

In my cross-examination of all Stages of Concern, it seemed that educators on Stages 5, 3 and 1 were the most proactive about this new approach to teaching as they shared common views and feelings about ICT integration. This conclusion drew attention to the potential of members of Stage 1, who could move to higher stages if their concerns were addressed properly, as well as Stage 3 members whose management concerns should be resolved in order for them to shift quicker to the impact stages of concern.

The analysis of the personal experience of elementary educators revealed that educators on Stages 5 were the most constructivist in their approach to teaching and learning and used ICT equipment in a manner that reflected their pedagogy and philosophy of teaching, followed by Stage 3 educators who were also exhibiting constructivist characteristics but to a lower degree. Based on research (Becker, 1994; Becker & Ravitz, 1999), using computer technology in practice makes teachers more constructivist. A period of three years, according to these studies, helped computer-using teachers change their instructional practices towards a constructivist pedagogy.

Teachers' perception of characteristics of ICT, which has an impact on the rate of adoption of this innovation revealed that Stage 5 educators believed that the present stage of ICT in schools was limiting its compatibility with teaching, while they felt more support was required to help teachers embrace this innovation. The complexity and the observability, the two characteristics that were under more scrutiny by teachers need to be considered when making recommendations.

In the following chapter, I complete this dissertation by presenting the final conclusions of this study, and discuss its contributions and limitations to research and practice. Based on the analysis of these findings and conclusions, I then frame a set of recommendations to support ICT integration in teaching in District X, and make suggestions for further research.

CHAPTER SEVEN
CONCLUSIONS, RECOMMENDATIONS, CONTRIBUTIONS, LIMITATIONS, AND FURTHER RESEARCH

I think children would change education and then children will challenge educators. I think they will challenge the paradigms and they are already challenging. I think they are looking for more online options, I think they know the tools that they are comfortable with, I think they want to own their learning and I think that if we don't respond to that, then many of us are going to be out of job and I think we need to make sure that we attend to that and also attend to our moral obligation to children in our future and I think we need to guide them and lead them into the world.

Dale, principal, teacher, Stage 5

I think it's part of our children's lives, our students' lives and it's not going to stop because certain people don't want it to move forward.

Cassie, resource teacher, Stage 3

Well. It's going to happen so we have to be sure that it's going to happen the way that we like.

George, classroom teacher, Stage 2

I guess an important thing is to try to get all teachers sort of computer literate to a certain degree because like I said there are still teachers who do not use computers.

Katherine, classroom teacher, Stage 1

... what the district is doing, are we going to get a resource person for every school, are they planning on upgrading so everybody has the same level of technology in their school, I need laptops if some elementary schools have them, you know why doesn't every elementary school have the same utility, with their resource person to teach us how to use them. Those are what things that come to mind.

Elizabeth, classroom teacher, Stage 0

Conclusions of this study

In the following sections, I discuss the findings of this mixed methods study in the context of technology implementation in District X with reference to the two theories that guided the research: *Rogers' Diffusion of Innovations* (1995) and *Concern-Based-Adoption Model* (Hall et al, 1973). I should mention that these conclusions guided me in formulating my recommendations, which are separately discussed in this chapter along with contributions and limitations to this study as well as areas for further research.

Based on Rogers (1995), *Innovation*, *Communication Channels*, *Time* and the *Social System* are the four main, identifiable elements in any diffusion study and program. In defining the *Social System*, Rogers highlights the importance of the direct influence of systems on the diffusion of an innovation and their indirect impact on their members. Overall, a review of literature also confirms that the districts' acknowledgement of advancement of technology and support of its diffusion is one important key toward technology integration in schools (Becker, 1994; Dean, 2001; Rowland et al., 2001). According to District X technology plans and the 2006/2007 District Strategic Plan, the District recognizes the importance of technology and the necessity of educating skilful and competent students who could tackle the issues and meet the challenges inherent in information-rich societies. They also acknowledge the necessity to provide schools with a District framework to guide decisions on learning through technology, allocate resources, and support schools and teachers in the learning process. Based on a District survey in October 2006, the District reported that

76% of staff agreed that the District was supporting change and innovation. However, it seems that more attention to technology integration in District X has only been reinforced in the last few years despite the fact that personal computers have been available in Canadian schools since the mid seventies. Based on the results of this study, a majority of teachers are still not successful adopters of educational technology, and most elementary educators are still concerned about the lack of sufficient, up-to-date equipment and support.

In defining *Innovation* as an important element of the diffusion process, Rogers (1995) refers to the process of diffusion, which includes four elements: the innovation, a knowledgeable and/or experienced individual or unit of adoption about the innovation, another individual or unit of adoption with no knowledge or experience about the innovation and a communication channel connecting the two adoption units. Based on the district's technology and strategic plans, the process of diffusion of ICT has been a priority since 1996. Therefore, the first element of the diffusion process being innovation—ICT in this case, has been studied and researched since the first District Technology Plan was originated in 1996 with a focus on infrastructure, hardware and software purchase. This plan was in line with CEO Year 1 in the four year agenda. The CEO forum on Education and Technology (http://www.ceoforum.org/history.html), a five-year partnership between business and education leaders (1996-2001) was formed to help ensure that all students attending American schools would achieve higher academic standards, and acquire necessary skills to become contributing citizens and productive workers in the 21st Century. In order to achieve these goals, the forum developed a four year agenda: Year 1: *The School Technology and Readiness Report: From Pillars to Progress*, Year 2: *Professional Development: A Link to Better Leaning*, Year 3: *The Teacher Preparation STaR Chart: A Self-Assessment Tool for Colleges of Education*, Year 4: *Education Proposals Must Be Included in Comprehensive Education Legislation*. According to CEO Year 1 agenda, it is important to provide schools with all the elements of education technology from hardware and connectivity to professional development and content. According to academic literature (Marcinkeiwicz, 1994; Pelgrum, 2001; Plante & Beattie, 2004) and based on the results of this study, although not sufficient, accessibility to technology is necessary for teachers to integrate technology in their practice.

The second District technology plan, completed in 2001 targeted instructional objectives to facilitate teaching and learning through the use of technology and attempted to provide staff with technology-based opportunities to develop skills and competencies. This priority was in agreement with CEO Year 2 agenda: *Professional Development: A Link to Better Leaning*. However, as evident from the results of this study, elementary schools in district X were still not equally equipped with respect to the quantity and quality of technology and support, which in turn might have delayed its meaningful educational use by educators. The lack of support can be highlighted by the fact that District X was willing to create new positions for a group of literacy teachers to visit schools periodically to support literacy goals, while all elementary schools did not all have technology support teachers on their staff. Starting in the spring of 2005, the

District reported more involvement with the diffusion of ICT at all levels to ensure equity and consistency among all elementary schools in the district in terms of hardware, software and educational support. The disparity of technology equipment among elementary schools in District X was again evidenced by a 2008/2009 statement for school technology support for School District X, in which the District Educational Technology Advisory Committee indicated that "[w]ith limited funds, equity continues to be a focus of the District to ensure schools with the greatest need and least ability to create equity on their own, receive District support."

As for professional development, another major key to guide and support teachers in their use of technology, the district has developed different innovative learning models and structures including *ICT Learning Teams* and *Technology Focus Groups* (see chapter 3, p. 74). The district also continues to develop its own portal, with the goal of transforming learning through this virtual community. Professional development has been agreed upon in literature (Buckenmeyer & Freitas 2005; Dean, 2001; Pelgrum, 2001; Plante & Beattie, 2004), as one of the most important factors in promoting technology integration into teaching, a conclusion which was also confirmed by educators in this research study, irrespective of their Stages of Concern. These educators wanted more time, better technology-focussed in-services and workshops as part of their professional development days. Based on a review of the district-wide 2008 February Professional Development Day Schedule, jointly sponsored by School District X along with the District X Teacher Association and District X Principals and Vice Principals Association, the only three technology related sessions offered on the day were: 1) *Facebook, Social internet sites and online stalkers* presented by the Vancouver Police Department, 2) *Getting started on Sharepoint Websites for beginners* by a District teacher, and 3) *What is Smartboard and how it changes teaching and learning* by a private company representative. Although informative and necessary, more sessions with a focus on the curricular integration of technology and its benefits for students' learning are required to support educators. This is a point confirmed by one of the interviewees, Cassie who stated: "...there is not a whole lot of in-services on ICT issues. There is a lot of committees but there is not in-services." The professional development days provide strong communication channels to attract and inform a larger population of teachers who often might not be involved with ICT learning teams, and help them reduce their uncertainty about this innovation.

Communication Channels, another key feature of Rogers' *Diffusion of Innovations* (1995), which includes both *Mass media channels* and *Interpersonal channels* helps create awareness and knowledge about an innovation. The latter involves direct and more persuasive exchange of information and new ideas between two or more individuals. In the context of District X, it is hoped by the District that a developing Portal would lead to a rich digital learning resource and community for students, staff and parents. Furthermore, those knowledgeable and experienced educators involved in a *Technology Focus Group* as well as any educator who has gained educational technology expertise and knowledge by the means of courses/workshops or self-teaching, represent the second element of the diffusion process (p. 18), with the aforementioned playing the role of technology ambassadors to their respective schools. The third element refers to all those teachers who are not yet familiar with educational technology. It is important that strong structures reinforced by District leadership and school administrators be used and modelled to connect such these two elements and increase their interactions at the district and school level. For example, the idea of *ICT Learning Teams* attempts to fulfil the fourth element of the diffusion process by connecting more experienced teachers and facilitators with teachers who wish to learn more about technology. However, based on this research, many teachers who do not participate in learning teams, lack the opportunity to witness the work of their more experienced and knowledgeable peers.

As explained by Rogers (1995), the rate of adoption of an innovation depends on the characteristics of innovations as perceived by individuals, such as the relative advantage of the innovation, its compatibility, complexity, trialability and observability. The majority of elementary educators in this study, perceived ICT integration as advantageous, compatible with what they did in their teaching and trialable mostly through ICT learning teams and/or for some through other forms of technology-related projects, certificates and diplomas. However, a larger proportion of interviewed educators still found ICT integration a complex process (8), and perceived its observability in their schools as low, as they did not have any structure in place to observe their colleagues' ICT-related work. If those teachers with a positive experience in ICT learning teams and in their practice could be given the opportunity to share their learning with other teachers in their schools, a wider population of teachers may become involved with integrating technology in their practice. Therefore, another communication channel that connects the learning team units with the school's staff units would help the adoption of ICT integration by a larger population of teachers. Obviously, those principals who encourage teachers in their schools to participate in ICT learning teams and provide space and time during staff meetings or by any other means, play a key role in strengthening the communication channel.

As explained by Rogers (1995), based on the relative earliness/lateness with which an innovation is adopted, five categories of innovation adopters can be distinguished: innovators, early adopters, early majority, late majority and laggards. It seems from the results of these findings that educators with impact concerns matched Roger's innovators and early adopter category as they expressed better leadership, were welcoming of change and were highly motivated and more inclined to take risks. They also had wider exposure to communication channels as they were more involved in technology-related committees and projects. Many were in leadership roles, such as administration and resource positions. Teachers with task-oriented concerns matched Roger's characteristics of the early majority, as they actively sought information about the most meaningful uses of technology, and ways they could become more efficient in managing technology-related tasks. Teachers with self-oriented concerns seemed to belong in varying degrees to the late majority or laggard categories. These teachers were using technology less extensively and required more time to think about technology or discuss the related issues and decisions carefully, and in some cases, they were more sceptical, cautious, more suspicious and resistant or less interested.

When innovation is the frame of reference, the phases in the change process are described as follows (Hall & Hord, 1987): Research, Development, Diffusion, Dissemination, Adoption, Implementation, Institutionalization, Refinement and Abandonment. As evident from the district performing and strategic plans and learning models that target technology professional development of teachers, the district is making an effort to move toward integration of technology into teaching practice, and it seems that Research, Development, gradual Diffusion, Dissemination and Adoption components of the change process have been slowly underway in the district. More research and cross-sectional surveys of larger District population are required to examine the state of adoption and implementation of ICT integration by elementary school educators. Nevertheless, based on this study, one can assume that ICT integration has not yet been "institutionalized" in District X, as a large number of elementary educators in the sample study reported being non-users of ICT when it came to its integration in their teaching. It is therefore important to continuously investigate factors that hold teachers back in their use of innovative approaches that have an impact on students' learning. These results reflect the importance of considering the stages of teachers' concerns about an innovation in order to propose proper methods of intervention based on their concerns and needs, and help them move towards better adoption of new approaches to learning.

In order to address attitudes and feelings that may be inhibiting teachers in their use of educational technology, Rakes and Casey (2002) recommend a concerns-based training model rather than a skills-based training model as one method that addresses feelings and attitudes that hold back teachers from using technology in their teaching. They explain that the inability of teachers to meaningfully use ICT in their teaching might be due to viewing the use of ICT in the classrooms as simple skill acquisition rather than focusing on a "change process that affects the behaviour of individuals on a very profound level" (p. 1). Atkins and Vasu (2000) recommend that Staff Development Departments investigate both teachers Stages of Concern and their knowledge and use of technology in instruction. This was based on their findings that demonstrated a significant correlation between teachers' Stages of Concern scores and their self-reported knowledge regarding technology use in classrooms, which was also confirmed by my research study.

The major purpose of my study was to identify the Stages of Concern of elementary educators in the study sample with regard to ICT integration, and determine and analyze their concerns with this innovation. Results revealed that the majority of respondents were not typical users of educational technology. There was a positive association between respondents' self-perception of computer expertise, the number of technology trainings and the type of activities they undertook in the past two years, the number of skills they were using personally and in their teaching, and their level of education. In the integrated interpretation of the quantitative and qualitative results, I concluded that there was a consistent pattern that related the views, feelings, experiences and perceptions of the interviewed elementary educators with their Stages of Concern, which was in agreement with the definition of concern. This conclusion justified the relationship between teachers' personal make-up, knowledge, and experience and the different kinds of concerns that they exhibited with regard to ICT integration in their practice (Hall et al., 1979).

Elementary educators in the study sample expressed concerns that I grouped into four major categories: concerns related to the philosophy of education and pedagogy, concerns related to accessibility, concerns related to technicality, and concerns related to integration. These concerns highlighted the importance of shifting the attention from the tool to the necessity of meaningful use of the tool to enhance learning, providing elementary teachers with ease of access to up-to-date ICT equipment and educational resources, and the support they require to become more comfortable and familiar with the logistics of ICT integration. These concerns could be addressed by providing these educators with the necessary time to develop professionally in order to take ownership of their new learning, based on their own individual levels and needs. The following recommendations are designed to specifically address these concerns.

Recommendations

The three dimensions of the CBAM which are independent from each other (Hall et al.,1973), *Stages of Concern (SoC), Levels of Use (LoU) and Innovation Configurations (IC)* allow change facilitators to accomplish ongoing concerns-based diagnosis, and recommend effective intervention strategies to facilitate, monitor and support the adoption process. Furthermore, the four main elements in Rogers'(1995) *Diffusion of Innovations: Innovation*, *Communication Channels*, *Time* and the *Social System,* are the identifiable features in any diffusion study and program, with the perceptions of characteristics of an innovation, being factors that impact the rate of adoption of innovations. The literature review in this study also highlighted many recommendations to better support the integration of ICT by teachers. In formulating my recommendations, I have referred to the following points that are supported by concerns-based guides (Hord et al., 2006, George et al., 2006):

- Different Stages of Concern should not be perceived as good or bad and people as better or worse. However, a change facilitator should be aware that interactions with teachers with high personal concerns might be different from those educators with high impact concerns.

- A change facilitator should pay special attention to the developmental and interactive nature of concerns. Teachers' movement through the Stages of Concern cannot be forced. However, appropriate support and assistance can facilitate this move while lack of assistance and ill-advised interventions may cease any prompt or encouragement to advance and/or discourage many potential adopters who might discontinue the use of the innovation. For example, professional development activities with a focus on the impact of the innovation might intensify personal concerns of teachers who might feel overwhelmed by the high demand expectations. In fact, it is important to understand the dynamic of facilitating change, which can be better achieved through day-to-day actions and/or interventions.

- Based on Hord et al. (2006):

> Concerns do not exist in vacuum. Concerns are influenced by participants' feelings about an innovation, by their perception of their ability to use it, by the setting in which the changes occurs, by the number of other changes in which they are involved and, most of all, by the kind of support and assistance they receive as they attempt to implement change. (p. 49)

Having all the aforementioned aspects of ICT integration in mind, and focusing on the findings of my research study, I present my recommendations in the following sections to address the District X elementary educators' concerns with regard to ICT integration in their practice.

1. District X should continue to prioritize and implement learning through technology as part of their strategic direction. This would put more emphasis on high profile activities such as equity initiatives and staffing priorities, similar to what is devoted to literacy goals for which a group of 8 to 10 recruited literacy teachers visit schools to support teachers. The ultimate goal should be to train every teacher to use ICT in their teaching. According to the World Link program (Carlson & Gadio, 2005), teachers require a minimum of 80 hours of professional development in order to start integrating technology into their practice.

2. District X should optimize the use of the available equipment. Based on the interviews, it seems that schools in District X are still not equally and similarly equipped with ICT-based equipment. Many respondents complained about old, inadequate, and scarce equipment in their schools. It is important for Districts to ensure that their elementary schools do not become a haven for old and donated

technology equipment, as elementary years build the foundations for future learning. Training teachers to work with the technology they might not have access to in their own school is both inefficient and frustrating for the trainee.

District X could optimize use of equipment by relocating and redesigning the computer settings. For example, Becker (1994) tells us that those teachers who have 5 to 8 computers in their classrooms do a better job in providing their students with a variety of research tools than those who schedule computer labs for their students in different time intervals. Therefore, in smaller elementary schools, it might be wiser to distribute all the laboratory computers amongst the classrooms so students have access to computers on a regular basis. In larger schools, computers can be relocated to a number of smaller centres at different locations in the school. Another meaningful addition to schools would be a portable lab consisting of a set of wireless laptops on rolling cart that could be easily moved from one class to another.

3. All the elementary schools in District X should have a knowledgeable and skilled part-time or full-time technology resource teacher (or teachers) on their staff who would model ICT-related activities and support teachers in integrating ICT in their teaching. Accessibility to technology tools is not sufficient by itself to persuade teachers to use and integrate them in their practice. Many educators in this study were concerned about immediate onsite support when dealing with technical issues, as well as the lack of a mentor and technology specialist on staff who could guide them with integrating ICT in their teaching. Teacher-librarians can also assume this task, as they act as information literacy

teachers in their respective schools. Research (Pelgrum, 2001; Plante & Beattie, 2004) shows that ongoing maintenance and technical support, and highly knowledgeable support personnel are important factors to sustain the quality use of ICT equipment in schools. Furthermore, teachers seem to learn better about ICT integration through informal mentoring, co-constructed collaborative and immediate learning (Granger et al., 2002). Therefore, the presence of a knowledgeable colleague in their own school would help teachers solve their ICT-based problems. The technology specialist teachers however, should not only be assigned to provide preparation blocs to teachers but they should also be able to team-teach and collaborate with their colleagues. As part of their assignment, these technology resource personnel should provide teachers with relevant resources, and collaborate with their school leadership team to develop and design school-wide activities that are used to facilitate a new vision on teaching and learning through a school-wide curriculum. Through continuous support and training, these teachers should also be allowed to fix the technical issues when possible instead of waiting for the district technicians to arrive.

4. Technology coordinators, learning team facilitators and school principals are encouraged to continue to support the integration of ICT in teaching by continuously monitoring and understanding the nature of teachers' concerns. Effective facilitators are able to encourage higher Stages of Concern among teachers while helping them resolve their existing concerns. Therefore, these key people need to be continuously trained and informed about different methods of concern assessment and evaluation. Hord, Rutherford, Hulling-

Austin and Hall (2006) suggest a set of interventions that might respond to teachers' Stages of Concern toward ICT integration (Appendix G, p. 323). By referring to these recommendations, technology coordinators, learning team facilitators and school principals would be able to continuously develop and/or adapt their own methods of interventions to the special needs of teachers. I discuss the implementation of this guide in more detail in item 5 below.

5. In light of the findings of this study whereby most teachers experienced personal concerns, (mostly Stage 0 concerns), the change facilitators and school principals should strengthen professional development through incorporating Hord et al's intervention guidelines. Overall, many teachers in the study felt that there was a general lack of ICT-related workshops that met their special needs. Most teachers also specified lack of time as an inhibiting factor in integrating ICT. Overall, professional development days provide the best opportunity in terms of time and space for these teachers to participate in workshops that address their special needs. The district-wide ProD committees should organize these sessions to consider the points described by Hord et al. in addressing individual concerns, such as offering sharing sessions where teachers with early stages of concern can discuss and make decisions about ICT and its integration; receive information that arouses their interest without being overwhelmed; see how ICT integration relates to their current practices; and see how the process of integration can be implemented gradually by establishing attainable expectations such as focussing on learning and mastering basic ICT skills. For in-school ProD's, visits

from people who have integrated ICT in their teaching should be organized, and opportunities should be provided for highly motivated teachers to share their work with others. Staff meetings can be another appropriate sharing structure.

6. School principals should provide their staff with plenty of opportunities to share technology-related work and projects. Findings from the interviews revealed that many teachers did not have a structure in their schools whereby teachers could share their technology projects. Observability is a perceived ICT characteristic that would allow teachers to make more informed decisions concerning the use of ICT in teaching (Rogers, 1995). Different structures such as sharing sessions, collaboration and modelling should be encouraged by principals.

7. ICT learning teams should address the individual needs of elementary educators more specifically. One of the concerns of the elementary educators in this study was related to the provision of proper and needs-related ICT-based professional development activities in their district. ICT learning teams were perceived as a meaningful and a successful strategy to learn about ICT integration and to work collegially with other colleagues. In a couple of cases however, teachers abandoned the ICT learning teams because they did not meet their needs, and in one case, the teacher was too intimidated by the prospect of joining a team. One teacher felt that she was too advanced for her technological needs to be met by learning teams. Overall, teachers felt that their level of knowledge and expertise was a constraint to the meaningful integration of ICT in teaching.

The nature of an innovation and the types of intervention can positively or negatively impact the development of Stages of Concern (Hall et al, 1987; Hall & Hord, 1987; Rogers, 1995). Dooley et al. (1999) emphasize the importance of creating less intimidating environments where a teacher would be able to work closely with a colleague who is compatible in terms of knowledge and skills. Therefore, gathering teachers in ICT learning teams, based on their concern type and/or level of ICT involvement could help teachers to meet and connect with other teachers at the district level, rather than just with people in their own school, and contribute to building trusting and safe places for professional dialogue and practice. Principals with different Stages of Concern should also be encouraged to participate in these technology learning teams. The positive impact of strong and informed leaders on the successful integration of ICT has been highlighted by research (Becker, 1994; Dean, 2001; Rowland et al., 2001).

One way to achieve this goal and enlist teachers based on their concern level is through the use of *SoCQ* or any other needs-assessment tool to quickly measure the Stages of Concern and/or level of involvement and use of elementary educators who have applied to the learning teams, and group them based on their types of concerns and/or level of involvement with ICT. For example, technology learning teams could be organized into three groups: self-concern, task-concern and impact-concern. In this manner, each group would be actively involved with colleagues who have similar Stages of Concern and involvement with technology and relevant resources provided by the district. Policies would need to be in place to assure teachers that the *SoCQ* (or any other needs assessment) is only being used as a diagnostic tool to facilitate the integration of ICT and not to evaluate them (George et al, 2006). As explained earlier and described in more detail in item 3 above, by referring to Hord et al's guide (2006), learning teams' facilitators can closely address teachers' needs and work toward arriving at higher late concerns. For example in an impact-concern team, the facilitator needs to share with the team members information that pertains to ICT integration and help them access the necessary resources to refine and implement their ideas into practice; provide them with opportunities to develop skills necessary for working with others and encourage them to provide technical assistance to those in need; and help them channel their ideas and energies in ways that will be productive rather than counterproductive. These skills can also be used by experienced facilitators within a learning team with various kinds of concerns. These facilitators can usually assess teachers and pair them up in homogenous groups and work with them within the same team.

Another effective tool that can be used to regroup teachers in ICT learning teams is the *Teaching with Technology Instrument* (Atkins & Vasu, 1998), which determines where teachers are with their use of technology in teaching and allows the staff development department to plan accordingly. This tool helps assess a teacher in three areas of technology use: (1) writing and communication, (2) information access and management, and (3) construction and multimedia. Based on teachers' scores, needs-based learning teams and/or professional development activities can be designed to help teachers focus on learning specific skills in an area and adapt their use in their teaching, instead of feeling overwhelmed or intimidated by a large amount of technology information.

Another alternative is to offer three types of learning teams for novice, intermediate and advanced ICT users and ask teachers to apply to these groups based on their perceptions of their own ICT expertise. Teachers who join each group will then develop a plan with the help of their facilitators that would help them achieve the level they desire. The facilitators in all these proposed options should also be trained in order to acquire the skills that they require to specifically address the special needs of their target group. This can also be reinforced by referring to the strategies offered by Hord et al. (2006, Appendix G, p. 323). Continuous evaluation of learning teams through feedback from the participants would also help to improve the quality of these teams based on teachers' needs.

8. All the learning team facilitators as well as literacy support teachers, no matter what their focus of inquiry is, should be provided with proper support and training to be able to integrate ICT in their topics of interest, and achieve the pedagogical and new teaching approaches to learning. Technology should become an integrated and transparent component of all learning teams in District X, no matter what their focus of inquiry is: math, sciences, language arts or other core subjects. As a result, ICT learning teams could specifically focus on such skills as writing and communication, information access and management, and construction and multimedia, providing an environment for teachers to acquire and improve technical skills and explore and learn about different programs and online resources.

Based on the interviews, it was evident that ICT was still used by teachers as an add-on to support the existing curriculum and/or isolated classroom activities. This was a concern for educators with high-impact concern levels, who were mostly in leadership positions in their schools. Based on research (Moersch, 1995), the opportunities provided for teachers to explore the potential of computer technology are oftentimes "insufficient and misdirected". Therefore, all learning teams should become a place to integrate ICT to achieve specified learning outcomes, based on instructional themes and concepts. Specialized facilitators in math, sciences and other subjects may be in a better position than generalist ICT learning team facilitators to encourage the meaningful integration of ICT to achieve desired outcomes relevant to their subjects. Such a structure could shift teachers' attention from pure ICT skill development to integrating new and innovative learning approaches into their teaching that meet the needs of their students.

9. The staff and professional development departments should model their offerings after high quality programs that focus on the use of technology to enhance classroom instruction and students' learning. Based on the interviews, teachers participating in college/university educational technology certificate/diploma programs had a very positive experience that changed their views significantly about the use of technology in teaching and its impact on students' learning. They were also well trained with the proper use of technology in the classroom. These programs are usually practical (self directed learning); relevant (needs-based and self-paced); transformative (reflecting on teaching

practice and setting learning goals), and collaborative (working with a mentor or colleagues on projects of interest).

10. The staff Development Department is encouraged to provide teachers with a combination of both in-site and online professional development activities. One way for teachers to become more familiar with the benefits of technology is to get more involved with it hands-on. For example, online professional development could be offered and supplemented by face-to-face meetings. This would allow teachers to work at their own pace and time, and focus on their own special needs.

11. All elementary educators should be continuously kept up to date with age-appropriate resources, expectations, guidelines and standards for teachers' use at district level especially with regard to regulations concerning ICT safety and supervision for children. One of the concerns of some elementary educators in this study was in relation to regulations concerning ICT safety and supervision for children. It seemed that there was a lack of consensus and know-how as to how to deal with ICT-related safety issues. Therefore, all elementary schools in District X should include cyberspace expectations in their code of conduct. Principals should review the District-wide network and internet appropriate use policies and procedures on a regular basis with their staff and students. However, based on District policy that states: "Teachers are expected to take all reasonable precautions to ensure that their students are not accessing inappropriate material on the Internet" as well as the concerns about safety expressed in the interviews, teachers may need to receive additional support

through administration and technology support teachers in order to reinforce ICT safety and netiquette with their students. District policies and netiquette should be more visible on district and schools' websites and easily accessible to the school population.

Another concern of the educators interviewed in this study was in relation to the lack of educational, age-appropriate and curriculum-relevant technology-based resources. Based on the interviews and other research (Plante & Beattie, 2004, SchoolNet Report, 2001), both teachers and students need to have access to high quality and curriculum-relevant online content and learnware. The District has attempted to respond to this need through developing its Portal. To accelerate this goal, District X should involve those educators who are members of impact/advanced ICT learning teams or those who are members of technology focus groups at the district level to assess and evaluate educational software and websites, and review and adopt such standards as the International Standards for Technology in Education (http://www.iste.org/standards/index.html) and/or standards developed for different competency levels by the Open Learning Agency in British Columbia (http://tll.ola.bc.ca) These assessed links as well as all the integrated resources and available guidelines and adopted expectations should be reviewed and made available to all teachers in the district through the District website and school technology specialists. These educators should be guided by facilitators who are specialized in educational technology resource evaluation, in developing a set of criteria for assessing and evaluating online resources that respond to the curricular goals and learning needs of students.

12. Teachers should be informed of the changing district technology-related policies and be included in technology decision making on a wider scale. A few interviewed teachers were concerned about their lack of awareness of district policies in relation to some of the technology-related initiatives, including the system change from Macs to PCs and the new report card templates, and felt that their autonomy was at stake. Research has proved that the complicity and cooperation of teachers is necessary to sustain any innovative change (Haddad & Draxler, 2005; Dooley, et al., 1999; Hall & Hord, 1987), and the inclusion of teachers in the design, development and delivery of professional development programs has an impact on their level of success (SchoolNet, 2001). Therefore, it is important for District X to inform its teacher population of all their technology-related policies, and continue to include them in designing and implementing related professional development activities.

Contributions of the study

I designed this study with the purpose of contributing to the process of technology implementation in District X in particular, and to the research on teacher concerns about innovation in general. My ultimate goal was for the findings of this research to enhance district policy as informed by *CBAM* (Hall et al., 1973) and Rogers (1995) *Diffusion of Innovations.*

The integration of ICT in teaching and learning in Canadian schools has been proved to be a complex and lengthy process (SchoolNet report, 2001). Personal computers were first introduced in Canadian schools in the mid 1970s, and with the growing potential of educational technology, provinces and territories continue to invest in integrating ICT in their educational systems. The national findings of Plante and Beattie (2004) confirmed that despite the accessibility of computer technology in schools, the meaningful integration of ICT is still not happening. In order to help and encourage teachers to adopt and integrate ICT in their teaching, their concerns should be addressed and understood, and the implementation of this innovation carefully monitored and appropriate intervention methods provided (George et al, 2006, Hall & Hord, 1987).

Attention to the findings and the four categories of elementary educators' concerns identified in this study will help the District staff development department, technology and program designers to develop and design appropriate professional development activities. Therefore, they will be able to use strategies that more closely address and meet teachers' individual concerns about integrating ICT in curriculum, and thus facilitating the change and implementation process. As a result, coordinators and facilitators would be able to support those who seem to lack enough time and expertise to concentrate on the innovation, or those who are suspicious and anxious about it, as well as the more involved and interested teachers, helping more educators to progress toward higher impact Stages of Concern where meaningful learning happens.

Limitations of the study

The results of this study are limited by a number of factors. First, the data was collected from educators in 14 elementary schools participating in ICT learning teams. Therefore, the study can be generalized to the population of elementary teachers only to the extent that the participating schools are representative of the District. Although I initiated multiple strategies to increase the response rate (including meeting with principals, introductory and follow-up e-mails and incentives, provision of clear instruction and envelopes, and using the district mail-bag for ease of delivery), only 27.4% of the surveys were returned. As a result, the ability to generalize the findings of this study to the population even in the study schools is limited. Rather, these findings should be viewed as one more data point to inform policy and practice in District X related to ICT integration.

I also believe that my position as a teacher and the timeline of this study limited me in reaching a larger population of educators in this study, because I was not in a position to meet with each staff in person to present my case and to have better ways to communicate with the participants than e-mails. I relied on school principals to administer the questionnaires as per their request, many of whom reminded me of the voluntary nature of the survey and the extremely busy schedule of their staff. One of the 15 schools did not agree to participate in the survey because of lack of interest and busy staff, and one principal asked me not to send introductory or follow-up messages to her staff. Therefore, I did not know when and how the questionnaires were administered to teachers and how well supported they were by principals.

In addition to the limitations stemming from areas of research that I as the researcher had direct involvement with, I was also limited in my access to district-wide demographic data, and ultimately had to access limited data through the

British Columbia Ministry of Education Educators Statistics, which only provided me with the gender, age and years of experience of educators across the K-12 level (and not specifically at the elementary level). These limitations helped me realize how important it is for districts to fully support their teacher-leaders/researchers and accelerate the research process by facilitating access to relevant information.

Another limitation was related to the way questionnaires were completed by educators. The research sample was self-selected and the data was gathered through voluntary and independent completion of the questionnaires. This also limits the generalizability of the findings. Data collection also relied solely on the honest responses of the educators and the true reflections of their concerns at the time of the survey. The participants' responses might have been influenced by immediate life events, by the way they completed the questionnaires (with or without interruptions), extra school activities and the busy workday at the school. Despite the fact that the questionnaires provided me with a list of voluntary educators for the interviews during which I had more control over the process and they had more time and flexibility to discuss similar and/or new issues, the selection of the interviewees from the survey population also limited my interview findings as the interview comments cannot be readily generalized to educators outside of the initial sample, and could only be viewed as clarifying and explaining the results to the questionnaire.

Although I did some peer debriefing to increase the validity of my content analysis, the inter-rater reliability (Weber, 1990) of my work could still be improved upon, had I been able to work with another investigator who could also code all the interview transcripts.

Further Research

Although I can not generalize the findings of this study to the general population of elementary teachers, the results helped me to formulate the preceding recommendations and to envision future research.

The lack of any relationship between the Stages of Concern of the responding educators in this study and the number of years they had used computers in teaching suggest the necessity of a more thorough investigation of the ways teachers integrate ICT in their teaching, and whether ICT integration is accomplished properly and meaningfully toward students' learning. The other two dimensions of CBAM, the *Level of use* and *Innovation configuration* (Hall et al, 1975; Hall & Hord, 1987) could be included in future studies as they provide change facilitators with two other diagnostic components of the CBAM to describe different levels of use of ICT by educators, and understand and describe the appropriateness of its use in their practice. The investigation of the impact of ICT integration on learning and its influence on curriculum renewal projects is another intriguing topic for further research. A longitudinal study to follow the changes in teacher concerns over time could offer an important contribution to understanding the process of change. A larger cross-sectional survey at the district level would also allow the development of individual school and district profiles.

Final comments

It was interesting for me to discover that my findings were in agreement with the results discussed in the literature at national and international levels with regard to the meaningful integration of ICT in teaching. The burning question still remains though: "Why is it that despite the costly investments on educational technology, a larger majority of teachers are not using the available ICT equipment in their teaching?"

The increasing application of technology in today's world is beginning to impact school teachers' understanding and perception of their role and pedagogical philosophy as well as their relationship with students, parents and the wider community. As school educators learn how to use new educational technologies, they begin to examine their beliefs, assumptions, and values, and the new knowledge will trigger in them different types of concerns that reflect their level of involvement with their changing environments. The psychological aspects of concerns (namely emotions, perceptions, attitudes, and feelings of teachers with regard to the innovative technology) should be addressed accordingly by school districts. Using the stages of concern framework (Hall et al, 1979; Hall & Hord, 1987), the individual concerns of educators can be identified and teachers can be supported with interventions appropriate to their specific needs. Through the collaborative work of change facilitators, technology support staff, staff development departments, school leaders and administrators, and the senior district leadership, opportunities can be provided for educators to exchange information, receive technical and educational support, and create proactive learning communities where collegiality and group work is reinforced, and dialogue around learning models and meaningful, innovative approaches to teaching and learning is supported.

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APPENDICES

Appendix A:
Stage of Concern Questionnaire

School Questionnaire/Code

Concerns Questionnaire

If you agree to participate in the interview process, please write your name here:

____

The purpose of this questionnaire is to determine what people who are using or thinking about using various programs are concerned about at various times during the innovation adoption process. The items were developed from typical responses of school and college teachers who ranged from no knowledge at all about various programs to many years experience in using them. Therefore, **a good part of the items on this questionnaire may appear to be of little relevance or irrelevant to you at this time**. For the completely irrelevant item, please choose "0" on the scale. Other items will represent the concern you do have, in varying degrees of intensity, and should be marked higher on the scale.

For example:

This statement is very true of me at this time.	0	1	2	3	4	5	6	⑦
This statement is somewhat true of me now.	0	1	2	3	④	5	6	7
This statement is not at all true of me at this time.	0	①	2	3	4	5	6	7
This statement seems irrelevant to me.	⓪	1	2	3	4	5	6	7

Please respond to the item in term of **your present concerns**, on how you feel about your involvement or potential involvement with **Information and Communication Technology (ICT) Integration in curriculum**. We do not hold any one definition of this innovation, so please think of it in terms of your own perceptions of what it involves. Since this questionnaire is used for a variety of innovations, the name **ICT Integration in curriculum** never appears. However, phrases such as "the innovation", "this approach", and "the new system" all refer to **ICT Integration in curriculum**. Remember to respond to each item in terms of your own present concerns about your involvement or potential involvement. Thank you for taking time to complete this task.

School Questionnaire/Code

0	1	2	3	4	5	6	7
Irrelevant		**Not true of me now**		**Somewhat true of me now**		**Very true of me now**	

Circle One Number For Each Item

1. I am concerned about students' attitudes toward the innovation.	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. I now know of some other approaches that might work better.	0	1	2	3	4	5	6	7
3. I am more concerned about another innovation.	0	1	2	3	4	5	6	7
4. I am concerned about not having enough time to organize myself each day.	0	1	2	3	4	5	6	7
5. I would like to help other faculty in their use of the innovation.	0	1	2	3	4	5	6	7
6. I have a very limited knowledge about the innovation.	0	1	2	3	4	5	6	7
7. I would like to know the effect of the reorganization on my professional status.	0	1	2	3	4	5	6	7
8. I am concerned about conflict between my interests and my responsibilities.	0	1	2	3	4	5	6	7
9. I am concerned about revising my use of innovation.	0	1	2	3	4	5	6	7
10. I would like to develop working relationships with both our faculty and outside faculty using this innovation.	0	1	2	3	4	5	6	7
11. I am concerned about how this innovation affects students.	0	1	2	3	4	5	6	7
12. I am not concerned about the innovation.	0	1	2	3	4	5	6	7
13. I would like to know who will make decisions in the new system.	0	1	2	3	4	5	6	7
14. I would like to discuss the possibility of using the innovation.	0	1	2	3	4	5	6	7
15. I would like to know what resources are available if we decide to adopt the innovation.	0	1	2	3	4	5	6	7
16. I am concerned about my inability to manage all the innovation requires.	0	1	2	3	4	5	6	7
17. I would like to know how my teaching or administration is supposed to change.	0	1	2	3	4	5	6	7
18. I would like to familiarize other departments or persons with the progress of this new approach.	0	1	2	3	4	5	6	7
19. I am concerned about evaluating my impact on students.	0	1	2	3	4	5	6	7
20. I would like to revise the innovation's approach.	0	1	2	3	4	5	6	7

0	1	2	3	4	5	6	7
Irrelevant		**Not true of me now**		**Somewhat true of me now**		**Very true of me now**	

Circle One Number For Each Item

21. I am preoccupied with things other than the innovation.	**0 1 2 3 4 5 6 7**
22. I would like to modify our use of the innovation based on the experiences of our students.	0 1 2 3 4 5 6 7
23. I spend little time thinking about the innovation.	0 1 2 3 4 5 6 7
24. I would like to excite my students about their part in this approach.	0 1 2 3 4 5 6 7
25. I am concerned about time spent working with nonacademic problems related to the innovation.	0 1 2 3 4 5 6 7
26. I would like to know what the use of the innovation will require in the immediate future.	0 1 2 3 4 5 6 7
27. I would like to coordinate my efforts with others to maximize the innovation's effects.	0 1 2 3 4 5 6 7
28. I would like to have more information on time and energy commitments required by the innovation.	0 1 2 3 4 5 6 7
29. I would like to know what other faculty are doing in this area.	0 1 2 3 4 5 6 7
30. Currently, other priorities prevent me from focusing my attention on the innovation.	0 1 2 3 4 5 6 7
31. I would like to determine how to supplement, enhance, or replace the innovation.	0 1 2 3 4 5 6 7
32. I would like to use feedback from students to change the program.	0 1 2 3 4 5 6 7
33. I would like to know how my role will change when I'm using the innovation.	0 1 2 3 4 5 6 7
34. Coordination of tasks and people is taking too much of my time.	0 1 2 3 4 5 6 7
35. I would like to know how the innovation is better than what we have now.	0 1 2 3 4 5 6 7

Appendix B:
Demographic Information Questionnaire

School/Questionnaire Code

DEMOGRAPHIC INFORMATION

The following demographic data is collected for comparative and statistical purposes only. It will not be used in any other way. Please complete the following and select the best answer that describes you. Thank you.

1.Gender:
O Male
O Female

2. Age:
O 20-29
O 30-39
O 40-49
O 50+

3. Highest Degree received:
O Bachelor
O Pb +15
O Masters
O Doctorate

4. Years of Teaching Experience:

5. Current Teaching Assignment:

6. How long have you been in your current school?

7. a) How many computers do you have in your classroom?

b) How many of them are connected to the internet?

8. a) Do you have access to computers at home?
O Yes O No

b) Do you have access to the internet at home?
O Yes O No

9. In your use of computers, do you consider yourself to be a(n):
O Nonuser O Novice O Intermediate
O Experienced

10. How long have you been using computers in your teaching?
O None O Less than a year O 1-2 year(s)
O 2-3 years O 3-5 years O More than 5 years

11. How many hours of courses, seminars, workshops and/or other trainings/preparations have you taken in the past two years that were oriented toward the use of computer technology?
O None O 1-9 Hour(s) O 10-19 Hours
O 20-39 Hours O 40 Hours or more

13. How many hours of release time have you received from your school/district in the past two years for computer technology training/preparation:

14. Please indicate if you have employed a computer in your teaching or for personal use to accomplish the following tasks. (Please check all that apply).

-Organizing files/folders on hard drive/File management	☐ In teaching	☐ Personal use
-Writing/Word processing	☐ In teaching	☐ Personal use
-Calculating/Spreadsheet	☐ In teaching	☐ Personal use
-Database	☐ In teaching	☐ Personal use
-Skills mastery/Drill and practice	☐ In teaching	☐ Personal use
-Research/Internet	☐ In teaching	☐ Personal use
-Community interaction/ Online discussions	☐ In teaching	☐ Personal use
-E-mail	☐ In teaching	☐ Personal use
-Graphics	☐ In teaching	☐ Personal use
-Programming	☐ In teaching	☐ Personal use
-Presentation	☐ In teaching	☐ Personal use
-Creating a Webpage	☐ In teaching	☐ Personal use
-Playing digital Media (video/audio)	☐ In teaching	☐ Personal use
-Editing Media (video/audio)	☐ In teaching	☐ Personal use
-Troubleshooting computer problems	☐ In teaching	☐ Personal use
-Creating a Network	☐ In teaching	☐ Personal use
-Games/Entertainment	☐ In teaching	☐ Personal use
-Special Purpose/Tax, Finance, etc.	☐ In teaching	☐ Personal use
-Online shopping	☐ In teaching	☐ Personal use

Please add any additional comments and/or concerns regarding ICT integration in elementary schools. Please use the back of this form if you need more space.

Appendix C
Summary of findings of the pilot test of the questionnaires

Background	**Teacher 1:** Female, 40-49, Masters, Gr 1 FI, +10 yrs, Novice **Teacher 2:** Male, 30-39, Masters, Gr. 4/5, Dept. head, 5 yrs, intermediate **Teacher 3:** 50+, Pb +15, Grade 2/3, 21 yrs, novice **Teacher 4:** 40-49, Masters, Gr. 4/5 FI, 19 Yrs, intermediate **Teacher 5:** 30-39, Bachelor, Teacher-librarian, 10 yrs, intermediate
What do you think about the SoCQ?	**T1:** I was not concerned about the Q. I was not panicked. The 0-7 scale is fabulous and gives enough voice. No parts were difficult to understand. **T2:** Straight forward, easy to fill out **T3:** I find it a bit confusing. I don't really have a full understanding or a clear understanding of what "Computer Technology Integration" means. **T4:** It's clear and mostly straightforward, although some questions are hard to connect to ICT ("I am concerned about conflict between my interests and my responsibilities?" It raises several questions about ICT implementation which I hadn't really thought about (eg, "effect on my professional status." **T5:** -What Stages? I don't understand the question. -Very good. Define "Concern". Don't understand Q7, 22, 31. Why not use ICT? I don't like innovation.
Is SocQ user-friendly the way it is presented in table format?	**T1:** Yes, easy to do. **T2:** Yes, no PB interpreting the Q, was not confused **T3:** Yes **T4:** Yes but I was unclear about the 7 scale. **T5:** Yes
Do you find instructions for completing SocQ clear & easy to follow?	**T1:** Instructions clear. Won't change anything. **T2:** Yes, read twice (personal), examples good, no confusion **T3:** Yes **T4:** Yes **T5:** Yes

Do you think the term used for the innovation, CTI is a proper term in regard to the purpose of this study? Which other suggestion did you prefer?	**T1:** Yes **T2:** Yes **T3:** I don't really have a full understanding or a clear understanding of what "Computer Technology Integration" means. I would suggest: "Using the computer to enhance the curriculum" **T4:** Computer Integration in Curriculum **T5:** Information and Communication Technology Integration in curriculum. Information literacy
What do you understand by CTI?	**T1:** How I use the technology in the subject/curriculum. Computer as a tool: extension of ways we do things. **T2:** using computers as a tool to teach my students: using programs/internet/software to teach curriculum/subject at elem. level **T3:** Make up worksheets. Kids know about computers more than me. If I was more knowledgeable, I would have used assignments using it in my teaching. -Define "teaching": helping students to understand new things. With Computers, showing students how to integrate CT to have access to new information that we could not get from their books. **T4:** Using computers to teach curriculum as opposed to going to computer and play. **T5:** Corporating computer lessons in the curriculum, activities, related skills
What do you understand by CTI in curriculum?	**T1:** This term will be better understood. **T2:** It is better understood, I prefer this one. At the secondary level, all the tools might be involved. **T3:** Writing process/drill/research. Maybe this term is better understood than CTI, just maybe. I like: Using the computer to enhance the curriculum **T4:** It makes it clear to me. CTI in curriculum is better understood than CTI. If you say across curriculum, it becomes intimidating because it implies that we need to do it in more than one subject as opposed to one unit here and there, which makes it easier. **T5:** Is the same because you talk to teachers. CTI might think it's too intimidating, might think is about programs
What do you understand by CT in teaching?	**T1:** The term "teaching" implies a new way of improved things-Flavor of the month/ imposed discipline pedagogy. How you need to do things instead of using curriculum. When I think of teaching, I think of ministry mandate. **T2:** Specific tools that I would use in my teaching. How well are these tools supported if something goes wrong with technicians. Concerns to buy and maintain technology. I think about the technical aspect. **T3:** I think about curriculum, the same. **T4:** This includes all professional aspects like e-mail, teaching. **T5:** Teaching something you do, can change. Curriculum is stable, does not change, not personal, objective. Teachers who like computers do activities with their class.

In the context of each of the above questions, do you see a difference between CT and ICT?	**T1:** I prefer CTI. ICTI is top down connotation-Newspeak **T2:** CT: Technical aspect/technical tools that I can use to teach: laptop, software/data project. ICT: I think about kids using internet to get information or a teacher getting information **T3:** The same. **T4:** The same. I would have answered the same way. **T5:** CT is completely no longer a valid term, too limited. ICT: Information is the key-99% would think computers Information: under umbrella of technology, internet, media, news, advertising, cell phone, e-mail Communications: forms of communication: e-mail, paper, memos, phone, computers
SocQ Completion time	**T1:** The whole package: 10 min. **T2:** 10 min **T3:** 25 min **T4:** 10 min **T5:** 13 min
What do you think about the DIQ?	**T1:** Easy to use **T2:** In depth, Q9 very thorough **T3:** Yes. It seems useful and easy to follow. This information is good to collect-but I think it all comes down to money. Do elementary schools have funds to implement such program? And keep it updated. Not all teachers are interested in computers and would rather have a computer "expert" teach the skills to their students. **T4:** The "Additional Comments" section belongs, I think, in the main questionnaire-not in the DIQ. **T5:** Where does the web design fall? Power Point? Shopping?
Is DQ user-friendly the way it is presented in table format?	**T1:** Yes **T2:** Yes **T3:** Yes **T4:** Yes **T5:** Yes
Were any of the questions difficult to understand?	**T1:** No. Add a space in Q9 between the main question and first answer. **T2:** No **T3:** Yes. I did not know if teaching meant myself preparing or teaching kids. **T4:** No. Q5 can be a little more clear and additional comments for Q15

	T5: No
Were the response choices adequate?	**T1:** Yes **T2:** Yes **T3:** Yes **T4:** Yes **T5:** Yes
Were there any questions that you thought should not have been asked? If yes, which one and why?	**T1:** No **T2:** Q13 did not apply to me **T3:** No **T4:** No. If someone feels sensitive, still can remain anonymous.
Were there any questions that should have been included but were not? If yes, which one and why?	**T1:** No **T2:** No. Q4: Pb+15 might not be called the same in other districts **T3:** No **T4:** No **T5:** Yes, Q4 How do you
"Q9: Please Indicate if you have employed a computer in your teaching or for personal use to accomplish the following tasks." **How did you define "your teaching"?**	**T1:** -at home/at school -Teaching: organizing, management, communication with parents -database to me means organizing -I believe when I make graphic organizers/cadre for kids in language arts, I reinforce students' learning through visual activities. I could do graphics by hand but it is easier with computers. **T2:** -Me using computer at school level organizing myself to teach my kids or directly teach my kids. By organizing, I mean using spreadsheet, word files, research, e-mail (more curricular), info -I think more of management than curriculum (a little) because of the terms used in this Q: e-mail, ... By management, I mean: lesson plans, typing, report cards, dept head sending info, managing my database **T3:** I did not know if teaching meant myself preparing or teaching kids. **T4:** Teaching refers to anything related to school: report cards, curriculum, ... **T5:** Anything that I do at school for the purpose of school.
"Q10: In your use of computers, do you consider yourself to be a(n) nonuser,....." **How do you define use of computers?**	**T1:** In general **T2:** In general **T3:** In general **T4:** In general

	T5: In general: my abilities, my knowledge of technology and my skills
"Q11: How long have you been using computers in your teaching?" **How did you define "your teaching"?**	**T1:** At school: word processing, e-mailing, communication with parents. **T2:** Me using CT as a tool to teach kids, I think more of curriculum delivery **T3:** Me teaching kids **T4:** Teaching your students, curriculum delivery **T5:** My current role as teacher-librarian
DQ Completion time	**T1:** The entire package: 10 min **T2:** 10 min **T3:** Whole package: 20 min **T4:** 4-6 min **T5:** 7 minutes
What do you think about the entire questionnaire package including the cover letter?	**T1:** --- **T2:** Well laid out and easy to understand. **T3:** I don't think I was a very good candidate to fill out the questionnaire because it is a topic that does not really interest me. I found it difficult. I was constantly re-reading the questions to make sure I understood the wording. **T4:** Your tone is very warm and friendly, making me want to help out. I wonder if more conciseness is possible in the letter. Also bigger print? Smaller print makes it too much like work. I am curious about what your research question(s) is/are? It might help me focus my answers if I knew you big question (s). Although I suppose the questionnaire questions hint at your big questions. In the SoCQ, I have a vague feeling that many questions are rewordings of previous questions, so I'm conscious that my answers may be inconsistent in some areas. That's probably just a reflection of your strategy in designing that questionnaire. **T5:** ----
Is there any problem with the design of the package?	**T1:** No **T2:** No **T3:** No **T4:** Small font. When I see it, it looks timely, more words. However, it is important to be warm and friendly than it is to be concise. **T5:** No
What did you think of the length of the entire questionnaire package?	**T1:** About right **T2:** About right

	T3: About right **T4:** About right **T5:** About right
Was the cover letter easy to understand?	**T1:** Yes-Shorten if possible. **T2:** A little long. Use brighter color: pink, orange. Some people might need more feedback on you. Visit the school on a weekly basis: define. Near future: explain. The thank you paragraph in first par.: Not needed **T3:** Yes **T4:** Clear and better explanation of the research and research question. **T5:** Little long
Is/are any part(s) redundant?	**T1:** No **T2:** No **T3:** No **T4:** Is it necessary to mention that Q is administered to ICT learning team schools? I would not have questioned why. **T5:** Little long
Is there any missing information/instructions that if added will encourage a higher response rate among teachers?	**T1:** No **T2:** More about yourself, so many years. Some people might want some background. **T3:** No **T4:** Starbucks is not necessary. The thank you part in first paragraph implies you might come back so just say that I hope this survey helps you think about aspects of ICT. **T5:** Consider of online survey. Put a question to make sure people only complete on Q, online or paper. Teachers might not read the questionnaire but might complete it online during their break. It's about IT so should be online.

Appendix D
Cover letter of the questionnaire package

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February , 2007

Dear Colleague,

I am a teacher at X Elementary School in X and a Doctoral student in the Faculty of Education at Simon Fraser University. The subject of my thesis is the study of perceptions and concerns of elementary school teachers with regard to the integration of Information and Communication Technology (ICT) in curriculum. As part of my research, I am administering the attached questionnaire which seeks to measure teachers' present concerns about ICT integration, to a sample of schools that participate in technology related activities such as ICT learning teams. Typically, the respondents need only 10-15 minutes to complete the questionnaire. Your voluntary participation in completing this questionnaire is greatly appreciated. **Please complete the questionnaire no matter what the extent of your involvement with ICT integration is** or whether or not you participate in an ICT learning team. Please place the completed questionnaire in the envelope included and send it to me using **the District mail bag by XX, 2007**.

Any information that is obtained during this study will be kept confidential. I should mention that this work has been approved by the board of ethics at SFU and I have received our district and your school principal's permissions to conduct my research. Thank you very much for your valuable participation in this research project. I place high value on the time, energy and insight you have to offer.

A follow-up interview will be conducted before the end of this school year with a sample of respondents to this questionnaire. This is to obtain a better and more thorough understanding of your perceptions, concerns and needs with regard to ICT integration. Please write your name in the space provided on the following page **if you are willing to participate in one brief follow-up interview**. Your name will not appear in any documents and the interview should take no longer than 45 minutes. Thank you in advance for your participation. I hope the findings of this research will be of value in our teaching. Results of this research can be obtained by contacting me at asamiei@----.

Truly Yours,

Armin Samiei

Appendix E
Guidelines for interviewing teachers and principals in regard to diffusion and integration of ICT in their practice

A Guide for Interviewing Teachers in regard to the Diffusion and Integration of ICT in their practice

I would like to get a picture of elementary educators' views and concerns with regard to the use of ICT in their practice. This is a visit to get acquainted with you. It's not an evaluation of you or of your school program. I have a number of questions to ask. There is no right or wrong answer to these questions and only your genuine views and opinions on different topics in this discussion count. Please take your time to express freely and openly to share your views and opinions in this friendly conversation. I would like to thank you in advance for your time and effort in participating in this interview.

1. Background
-Are you at this time involved with any innovations such as learning teams, pilot-testing of any programs, etc? If yes, please describe briefly the nature of the innovation.

2. I am interested in your general views and feelings concerning the use of ICT in your practice.
-I am interested in your general views concerning the integration of ICT in your practice
-How do you feel about it?
-Any concerns you have about it? What issues are you dealing with at this point in time?

3. I am interested in learning about your own personal experience with computer-based ICT in your practice.
-Are you using the computer-based ICT equipment your school purchases?
-How much access do you have to a computer lab? How often do you use it? What happens when there is a technical problem?
-How do you use computer-based ICT in your teaching.
-Has student achievement been enhanced using ICT?
-If you are a part of a project using technology, please expand on it.
-What barriers have you encountered to the integration of computer-based ICT in curriculum?
-How could you be better supported in your involvement with computer-based ICT?

4. I am interested in learning how you perceive the characteristics of computer-based ICT in your practice.
-Is integration of computer-based ICT in curriculum advantageous? What advantages and/or disadvantages do you see regarding the integration of computer-based ICT in curriculum?
-Is computer-based ICT integration compatible with what teachers do in your school? Would you please expand on this.
-Is computer-based ICT difficult to understand and integrate? If yes, why?
-Is it possible in your school to try and experiment with integrating computer-based ICT in curriculum? If yes, how and why do you experiment?
-What opportunities have you had to share and see examples of other users' work or the results of computer-based ICT integration by your colleagues in your school?

5. Final words
-All things considered, is integrating ICT in curriculum worthwhile?
-What questions do you have now or do you have anything else to add?

Thank you very much for your time and feedback. You have definitely helped me a lot with my research.

A Guide for Interviewing Principals in regard to the Diffusion and Use of Computer Technology in schools

I would like to get a picture of elementary educators' views and concerns with regard to the use of ICT in their practice. This is a visit to get acquainted with you. It's not an evaluation of you or of your school program. I have a number of questions to ask. There is no right or wrong answer to these questions and only your genuine views and opinions on different topics in this discussion count. Please take your time to express freely and openly to share your views and opinions in this friendly conversation. I would like to thank you in advance for your time and effort in participating in this interview.

1. Background

-How long have you been an administrator?
-How long did you teach before becoming an administrator?
-How long have you been in this school?
-Is your school involved with any innovations such as learning teams, pilot-testing of any programs, etc at this time?

2. I am interested in your general views and feelings concerning the use of ICT in schools.

-I am interested in your general views concerning the integration of ICT in your practice
-How do you feel about it?
-Any concerns you have about it? What issues are you dealing with at this point in time?
-How do your teachers see ICT integration?

3. I am interested to learn about your own personal experience with computer-based ICT in your practice.

-Is all the computer-based ICT equipment your school purchases being used?
-How do you use computer-based ICT in your practice?
-Has student achievement been enhanced using ICT?
-What barriers to the integration of computer-based ICT in curriculum have you encountered?
-How could teachers be better supported in their involvement with computer-based ICT?

4. I am interested in learning how you perceive the characteristics of computer-based ICT in your practice.

-Is integration of computer-based ICT in curriculum advantageous? Would you please expand on this.
-Is computer-based ICT integration compatible with what teachers do in your school? Would you please expand on this.
-Is computer-based ICT difficult to understand and integrate? If yes, why?
-Is it possible in your school to try and experiment with integrating computer-based ICT in curriculum? If yes, how and why do you experiment?
-What opportunities have you had to share and see examples of other users' work or the results of computer-based ICT integration by your colleagues in your school?

5. Final words

-All things considered, is integrating ICT in curriculum worthwhile?
-Do you have anything else to add?

Thank you very much for your time and feedback. You have definitely helped me a lot with my research.

Appendix F
ICT equipment availability and its use by elementary educators in their schools

School #	Name	ICT equipment use	ICT equipment available in respective schools based on the participants' awareness
1	Chloe	Yes	a computer lab, a broken scanner, a smartboard, the computers, the printer, a digital camera, two laptops, one LCD projector, DVD player
2	Ron	Yes	a computer lab with 32 eMac and newer iMac workstations, a window server and a Macintosh server, eMac workstation for students, a PC for each classroom, 2 digital cameras, computer digital projector, mobile AV chart with digital projector and the laptop
3	Doris	Yes	a computer lab., video camera, a camera, LCD prjector
4	Jim	Yes	a computer lab, personal computers for teachers, televisions, VCR's, DVD players, one digital camera
4	Katherine	Yes	"We don't even have an overhead projector in our lab…"
4	Kim	Yes	one computer with internet access in each classroom, a computer lab., a digital camera
4	Dan	Yes	computers, overhead devices
4	Sara	Yes	Not discussed.
6	Dale	Yes	90% pre-owed computers, 10% new computers usually office-based or teachers' general use computers, a lab. With 30 PC's, 3 computers for resource purposes in the library, 3 computers in the office, one computer for general teacher use in the staff development room, classroom teachers' pre-own PC's, one set of 30 Macintosh iBooks, 6 PC computers for students with special needs, three laser printers and a printer copier, a digital camera, two wireless routers, digital video camera, digital still camera, 2 LCD projectors
6	Paul	Yes	computers, digital camera, a projector, laptops for Gr. 4's and 5's, printers, a scanner

School #	Name	ICT equipment use	ICT equipment available in respective schools based on the participants' awareness
7	Cassie	Yes	computers in every classroom, computers in the library, a scanner, a lab., digital cameras, DVD machines, a photocopier
7	Olivia	Yes	two computers in my classroom, one Mac for students, one for teachers, a projector, computer lab, a digital camera
8	Beverly	Minimally	computer lab., some good programs, digital cameras, old projector
8	Elizabeth	Yes	a computer room with 30 computers, one or two older computers in each classroom, two printers, one black and white in the computer room and one colored at the office, a few computer programs on the computer like the old Oregan Trail, a few games, Kidpiration, Hyperstudio, internet, two digital cameras, an old projector
12	Sue	Yes	A computer lab, LCD projectors, microphones, headsets, Smartboards, printers, one digital camera, TV's, DVD's
13	Jeannette	Yes	Two smartboards, computers, printer, scanner
14	George	Yes	An old LC475 Mac in the classroom, new Dells, PA system, LCD projectors, 6 to 8 digital cameras, color photography printers, a fabulous performance system for concerts, wireless microphones, many electronic pianos

Appendix G
Guidelines for concern interventions

Guidelines by Hord, Rutherford, Huling-Austin, and Hall (2006)

Stage O-Awareness Concerns
A. If possible, involve teachers in discussions and decisions about the innovation and its implementation.
B. Share enough information to arouse interest, but not so much that it overwhelms.
C. Acknowledge that a lack of awareness is expected and reasonable, and that no questions about the innovation are foolish.
D. Encourage unaware persons to talk with colleagues who know about the innovation.
E. Take steps to minimize gossip and inaccurate sharing of information about the innovation.

Stage 1-Informational Concerns
A. Provide clear and accurate information about the innovation.
B. Use a variety of ways to share information-verbally, in writing, and through any available media. Communicate with individuals and with small and large groups.
C. Have persons who have used the innovation in other settings visit with your teachers. Visits to user schools could also be arranged.
D. Help teachers see how the innovation relates to their current practices, both in regard to similarities and differences.
E. Be enthusiastic and enhance the visibility of others who are excited.

Stage 2-Personal Concerns
A. Legitimize the existence and expression of personal concerns. Knowing these concerns are common and that others have them can be comforting.
B. Use personal notes and conversations to provide encouragement and reinforce personal adequacy.
D. Connect these teachers with others whose personal concerns have diminished and who will be supportive.
E. Show how the innovation can be implemented sequentially rather than in one big leap. It is important to establish expectations that are attainable.
F. Do not push innovation use, but encourage and support it while maintaining expectations.

Stage 3-Management Concerns
A. Clarify the steps and components of the innovation. Information from innovation configurations will be helpful here.
B. Provide answers that address the small specific "how-to" issues that are so

often the cause of management concerns.
C. Demonstrate exact and practical solutions to the logistical problems that contribute to these concerns.
D. Help teachers sequence specific activities and set timelines for their accomplishments.
E. Attend to the immediate demands of the innovation, not what will be or could be in the future.

Stage 4-Consequence Concerns
A. Provide these individuals with opportunities to visit other settings where the innovation is in use and to attend conferences on the topic.
B. Don't overlook these individuals. Give them positive feedback and needed support.
C. Find opportunities for these persons to share their skills with others.
D. Share with these persons information pertaining to the innovation.

Stage 5-Collaboration Concerns
A. Provide these individuals with opportunities
B. Bring together those persons, both within and outside the school, who are interested in collaboration.
C. Help the collaborators establish reasonable expectations and guidelines for the collaborative effort.
D. Use these persons to provide technical assistance to others who need assistance.
E. Encourage the collaborators, but don't attempt to force collaboration on those who are not interested.

Stage 6-Refocusing Concerns
A. Respect and encourage the interest these persons have for finding a better way.
B. Help these individuals channel their ideas and energies in ways
C. that will be productive rather than counterproductive.
D. Encourage these individuals to act on their concerns for program improvement.
E. Help these persons access the resources they may need to refine their ideas and put them into practice.
F. Be aware of and willing to accept the fact these persons may replace or significantly modify the existing innovations.