Ctrl-Alt-Change: Educators' Perceptions of Technology in Schools.

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by

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Abstract

A review of literature regarding technology in education revealed that there are at least four key areas that influence educators' use of technology in the classroom. These are change forces and responses, educational beliefs, perceptions of self-efficacy, and the current conditions in today's educational institutions. The main objective of this research was to investigate the perceptions of individual educators regarding the incorporation of technology in elementary and secondary schools, with a focus on the following research questions: 1) To what degree has the educator's instructional strategies been informed by technological change? 2) To what degree has self-efficacy played in the educator's use of or lack of use of technology in the classroom? 3) What has been the educator's perception of the best practice of incorporating technology in the classroom?

A semi-structured interview method was used, as well as the incorporation of a visual perception spectrum. Data were collected from ten educators using semi-structured interviews, a visual perception spectrum device, and researcher observations.

The interviews helped gain an understanding of the educators' perceptions of the changes that they have faced due to technology, their feelings of self-efficacy towards teaching using technology, and their perceptions of the best use of technology in the classroom.

Data were collected from ten educators in an urban school division. Five educators taught high school and five taught elementary school. The sample included administrators, primary teachers, middle years teachers, learning assistance teachers,

and subject-specific high school teachers with a range in years experience and technology training.

It was found that these educators had strong feelings regarding the difference they have made in their students' lives, with or without the use of technology in education, and had an understanding of the forces around them that have promoted or inhibited the use of technology in education. These educators were aware of the potential benefits and uses for technology in education, and were comfortable with the changes that this implied for them. However, there was a variance in the degree to which these educators employed technology in their teaching, as well as a variance in their perceptions of the purposes for using technology in the classroom.

These educators relayed the message that technology was being used in meaningful ways in and out of the classroom for valuable educational purposes. The educators' personal contact with and knowledge of the students gave them the best vantage point from which to assess what their students needed and how they could attain it. These educators strongly emphasized that although there has been a push to employ technology in the classroom, it has not been incorporated into their teaching unless it served a meaningful and beneficial purpose. There was no uniform 'best practice' found from this study. Rather, it appeared that the best practice was to have the best equipment possible, with good software, so that the educator could have access to it when he/she saw fit, in flow and sequence, aligned with the students' needs, whenever its use was deemed appropriate and meaningful.

Implications of this study for theory are that there may be too great a focus on the gap regarding the use of technology between society and education, as well as the implication that educators may be more resilient to change than theory suggests.

Implications of this study for practice include consideration into the development of a group of 'integration specialists' to model or assist in technology integration in elementary, high schools and pre-service education, as well as a look into the use of a technology specialist teacher in the middle years.

Implications for future research include: research into collating a 'best practice' collection of ideas for technology integration; research into the outside pressures that educators feel to use technology despite what their beliefs may be; research into the best uses of technology for special needs students; and research into what the development of a team of 'integration specialists' and/or a middle years technology specialist could do for a school or school division.

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Chapter 1

Introduction to the Problem

In this fast paced-technology driven world, educators can be certain of one thing; "today, there is more change to contend with than ever before. The volume, momentum, and complexity of change is accelerating at an increasing rate" (Conner, 1993, p. 38). Educators are faced with changing societal values, shifts in the meaning of family, new curriculum, youth issues, and shifting paradigms reflecting the values of education. Perhaps the largest of these change phenomena is the prevalence of technology in today's society. Businesses and industries have embraced technology as a means to produce more, better, and faster; but today's schools have not necessarily responded to the technological shifts in the way that society has. Cuban (1996b) said, "If there is one institution that techno-reformers have sought again and again to revolutionize, it's the public schools…Techno-reformers, mostly…noneducators far removed from classrooms, deeply believe in the power of technology to transform schools into productive workplaces" (p. 1).

From the past decade, writers have asserted that businesses and schools do not resemble each other in the provisions for nor in the use of technology in schools.

> If teaching professionals frozen 300 years ago came alive today and looked at other professions – a physician in an operating theater, a pilot in a cockpit, an engineer designing an automobile in cyberspace – they would marvel at how technologies had transformed their work. But if they walked into a classroom, they

would no doubt be comforted that little had changed. (Tapscott, 2001, p. 4)

Educational stakeholders, such as parents, business owners, post secondary educators, and the general public might ask why such a large gap exists in technology use between other institutions and schools, and what educational institutions could be doing do to bridge this gap (Hodas, 1993; Keenan, 2000; McKenzie, 1993).

Authors supporting technology argued not only for an increase in the use of technology in the classroom, but also for transformations in the approaches to teaching technology. These authors propone that the current system no longer serves the needs of today's students (Hodas, 1993; Keenan, 2000; Salisbury, 1996).

Countering these views are the understated arguments against an increase of technology in education. Hewitt (2000) reminded us that computers are not the first technology that were thought to revolutionize education. This was also thought to be the case with the introduction of Thomas Edison's motion pictures, as well as television and radio. "Edison believed that the best lessons of the best teachers in the world would be captured on film and distributed to schools everywhere" (p. 33), but that in the end, this did not happen. "For the most part, teachers felt quite comfortable presenting content. The bigger challenge in the classroom was one of ensuring that students were engaged and doing something with the content that fosters deep, rather than superficial understanding" (p. 33). From these observations, Hewitt further explained that the failure of these technologies to revolutionize education was not surprising, and that the introduction of new technologies has followed a pattern.

Cuban (1990) outlined this pattern as including: a) introduction and enthusiasm; b) preliminary research; c) failure to achieve expectations; d) technology deemed inefficient and costly; and e) disillusionment and abandonment.

Hewitt (2000), along with other researchers like Alison Armstrong and Charles Casement (1998), stated that it is not likely that computers will follow Cuban's (1990) pattern to total technology abandonment, but we must be careful not to accept computer technology as revolutionary either. It is true that computers are different from other previous technologies since they are interactive, while the motion picture and television are not; but we have to study the benefits of technology incorporation versus costs carefully, before we invest in technology in schools.

Armstrong and Casement (1999) emphasized that a dramatic push for more technology in schools is not what is needed; but instead, more focus must be placed on the basic teacher and student relationship. They argued that educators must continue to focus on books, personal communication and pen-to-paper literacy skills, in order to serve the best interests of the students (Armstrong & Casement, 1999; Cuban, 2000; McKenzie, 2003).

The resolution of this decadal debate does not appear to be close at hand, and because technology is changing at a rapid pace, the debate concerning what constitutes the best uses for technology in education will evolve from year to year.

There appear to be four categories, in literature, which influence the degree to which educators incorporate technology in education. These are: 1) the individuals' and institution's response to change; 2) educators' beliefs about effective educational practices; 3) educators' perceptions of self-efficacy in the classroom; and 4) current

conditions in education. These four areas will be explored in the literature review and will be the focus of elaboration as they are relevant in the conceptual framework and research problem for this study.

Purpose of this study

It has been revealed, in literature, that "techno-reformers have seldom been pleased with the pace of classroom change or the ways that teachers have used new machines" (Cuban, 1996b, p. 1). There are, however, proponents who argue the opposite, stating that "in integrating computers into our classrooms we should…proceed with caution" (Armstrong & Casement, 1998, p.11). The literature review, in chapter two, will provide background to these two conflicting views, as well as information regarding change, educational beliefs, self-efficacy and conditions in education today.

At the outset of this study, it was the contention of this researcher that we do not have sufficient insight into the perceptions that professional educators have concerning technology in schools and classrooms. Educators are thrust into a situation of ambiguity, of criticism, of change and of uncertainty when they are expected to introduce technology in education in ways that technology has been incorporated into society, in general. "Technology-learning policymakers, corporate leaders, and other influential noneducators, with their access to the media, have framed both the problem and the solution. Teachers, then and now, remain voiceless in setting the reform agenda" (Cuban, 1996b, p. 2). It was the researcher's intention to give voice to educators with respect to technology in their schools and classrooms.

Johnston (1999) illustrated a possible gap in educational reform with respect to technology. In an article on the role of teachers in technology, he described an advertisement in a 1970s vintage magazine, focusing on educational planning, which featured a smiling student wearing headphones with a collage of images around him, consisting of a satellite, a teacher in front of a camera, and a large tape-driven computer. Johnston then compared this ad with a more recent one in Education Week, featuring stacks of CD-ROM disks. He stated that both advertisements illustrated technology current for the time, but the more recent advertisement focused on just technology and computer disks "while our 1970 magazine ***focused on the student*** with technology in the *background*" (p. 3) [emphasis added]. Johnston implied that often we go beyond the human element, considering only the technology itself without considering the humans on whom technology has an impact.

Both Judah (1999) and Johnston (1999) evoked their views by indicating that much more attention needs to be paid to the perceptions of the educators than solely on technology and its implications. They advised educational institutions, those eager to buy into technology, to be mindful of the growing tendency to minimize the place of teachers in teaching, and that "effective implementation of technology requires consultation with concerned teachers" (Judah, 1999, p. 18).

Although criticisms abound regarding the use of technology in education, little information is offered as to what may be the best practice for incorporating technology into education. A recommendation, following a study on the uses of computers in the elementary grades, by Smita (2003) was that "another research study needs to be done to investigate the most effective method of integrating computers in

classrooms at elementary levels" (p. 348). Perhaps it is with a more in depth understanding of the realities of change, beliefs of educational practices, self-efficacy and conditions in education, that we may discover what the educators' perceptions of the best practice of incorporating technology in the classroom might be.

Main Objective of the Research

The objective of this research was to investigate the perceptions of individual educators regarding the incorporation of technology in education, specifically in the classrooms of both elementary and high schools, with a focus on the following research questions:

1) To what degree has the educator's instructional strategies been informed by technological change?

2) To what degree has self-efficacy played in the educator's use of or lack of use of technology in the classroom?

3) What has been the educator's perception of the best practice of incorporating technology in the classroom?

Significance of the Study

Due to the rapid and ever-changing nature of technology, "we cannot assume that answers provided five years ago are valid, relevant or useful today" (Breuleux, 2001, p. 13). Therefore, this investigation was timely and valuable in the continuous attempts to improve education through the ways in which we incorporate technology in education.

This research provided useful information regarding the degree to which the educator's instructional strategies have been informed by technological change, to what degree self-efficacy has played in the individual educator's use of or lack of use of technology in the classroom, and the educator's perception of the best practice of incorporating technology in the classroom.

Hargreaves and Fullan (1992) stated that "…the skills in which teachers are trained are all too often implemented out of context – their appropriateness for the teacher as a person, for the teacher's purpose, or for the particular classroom setting in which the teacher works, being overlooked" (p. 6).

By understanding how the individual educator's strategies have been informed by technological change and to what degree self-efficacy has played in the individual educator's use of or lack of use of technology in the classroom, perhaps the gap that Johnson (1999) illustrated between technology and educational reform may be lessened.

The title of the study, Ctrl-Alt-Change: Educators' Perceptions of Technology in Schools, was chosen for its fit to both the purpose of the study and the nature of education. The study of educators' perceptions of technology in schools necessitated a clear title to identify what the study was set to do and the data that was collected. Educators, however, are often presented with the task of getting the attention of their 'audience' and presenting material in a creative way, therefore, the three words in front of the colon reflect the nature of education. Ctrl-Alt-Change is fitting for the title of a study of technology in education because of its creative and attention getting nature.

Definitions

"A definition is the enclosing a wilderness of idea within a wall of words."

~ Samuel Butler, retrieved fromhttp://www.quotegarden.com/language.html

Technology often brings with it language that is unique to its application and understanding. The following terms are defined here as they are used in this study.

Change – Change refers to an alteration of current practices, expectations or situations as we come to expect of them. "Change is often perceived as a perplexing jungle that many people, organizations, and even whole societies enter only to become entangled in the undergrowth and confusion and dysfunction" (Conner, 1993, p. ixx).

Perceptions – Perceptions refers to the ideas, thoughts and feelings from the educator's point of view, drawn from experience, knowledge and skills.

Self-Efficacy – For this study, self-efficacy refers to the educator's belief in being able to effect change in the classroom – to make a difference in their students' lives. Self efficacy is "…the exercise of human agency through people's beliefs in their capabilities to produce desired effects by their actions" (Bandura, 1997, p. vii).

Technological Reform – This refers to large-scale changes or complete transformations that some scholars insist is required in education to bring students up to the level of technology use in business and the private sector.

Technology – Technology is defined as "computer hardware that is used both academically and professionally with applications (e.g., word processing, PowerPoint, spreadsheets, and databases), educational software, the Internet, and online instructional systems (e.g., Blackboard)" (Wepner, Ziomek, & Tao, 2003, p. 53).

Delimitations

This study sought to investigate the perceptions of educators in elementary and secondary schools as to what degree individual educator's strategies have been informed by technological change, what degree self-efficacy has played in the educator's use of or lack of use of technology in the classroom, and what has been the educator's perception of the best practice of incorporating technology in the classroom. Data were collected from interviews with current educators in one urban school division. Ten educators were selected using purposive sampling to obtain potentially meaningful data. This study was conducted between February 2004 and May 2004.

Limitations

This study was subject to the following limitations:

1. Information was collected using a semi-structured interview methodology, thus limitations imposed by the naturalistic investigation methods applied. These limitations were that the sample size was small, the data were non-statistical in nature, and the research was intended to increase the understanding for the reader rather than provide results for verification or generalization.

2. This study relied on the participants' willingness to answer questions and be open with their perceptions and expressions.

3. Information that was collected regarding technological change and reform is time-sensitive, due to the rapid changes in computers, the Internet and the

technological industry, thus information in this study is not to be generalized over a long time frame nor to other populations of educators.

4. This study had a small sample size, with five elementary and five high school educator participants. The educators were employed in one urban school division. Attention was neither given to career stage nor to any technological training or professional development.

5. Efforts were made to conduct interviews with participants using an in-person interview of approximately one hour in duration. Despite these efforts, the nature of the investigation provided more of a 'snapshot' of what was occurring in the educators' lives at a specific point in time and cannot be generalized over their careers.

Assumptions

This study made the assumption that some form of technological change, reform, or adaptation is required or is taking place in elementary and secondary education. It also assumed that educators are instrumental in affecting change in terms of technology in education and that to some degree, recognize various challenges (either positive or negative) in implementing this technological change.

Organization of the Thesis

Chapter 1 of this thesis provides the background to the nature of the study, as well as a description of some of the language used in technology and its applications.

Chapter 2 is a review of literature surrounding the issue of technology in education with respect to personal and institutional change, educators' beliefs regarding effective teaching strategies, self-efficacy and its role in motivating educators, and the current issues in educational institutions today.

Chapter 3 is a detailed look into the design of the research, as well as the methods incorporated to execute the research.

Chapter 4 is a synthesis of the data collected from the research, outlining the perceptions of the educators interviewed, their responses on the visual perception spectrum, the observations collected, and a summary of the themes observed as they serve to answer the research questions.

Chapter 5 contains the discussion and implications, which provides further discussion to the three research questions, as well as implications for further research.

Chapter 2

Literature Review

Introduction

The nature of the research problem, exploring educators' perceptions of technology in education required an understanding of the literature surrounding change, effective educational practices, self-efficacy and current conditions in educational institutions today. The first section of this review explores change as it relates to the individual as well as the organization. This helps to explain the context in which teachers respond to technology changes. The second section presents literature on effective educational practices in classrooms, including proponents of educational transformation, as well as those who argue that effective teaching lies in traditional strategies. The third section of this review covers the ideas of self-efficacy, the belief that a teacher has in being able to make a difference in students' lives, and the fourth section summarizes the conditions that educators face on the job on a daily basis.

Following this review of literature is a section presenting the conceptual framework of this study, outlining the relevance of these four major areas of literature to the research questions, as well providing a diagram to illustrate how the questions evolved from the literature and previous research.

Change

When looking at our society today, one needs little imagination to assess that life today bears little resemblance to life 100, 50 or even 25 years ago. "Never before has so much changed so fast and with such dramatic implications for the entire world" (Conner, 1993, p. 3). The largest of these changes is the prevalence of technology in today's society, moving toward faster and larger scale transactions, leaving behind traditional life as we know it. "Teaching has become incredibly more complex over the past few years. Breadth of teachers' classroom repertoires is expanding because of the developments in the science of teaching, the spread of information technologies, and the challenge of adapting instruction to the needs and learning styles of students…" (Hargreaves & Fullan, 2000, p. 50). Businesses and government have incorporated new, fast paced, wired methods of communication, and society has been transformed by this change to the point that daily contact with technology is almost inevitable.

Implications of Change

It is not change itself that causes havoc in people's lives. Rather, it is the implications that come along with the change that cause difficulty (Conner, 1993). By this, Conner stated that change itself is not the issue, instead it is the way that people and institutions respond to the change that result in accepting change or resisting it. The responses to change vary, depending on the scale of the change. If the scale is large enough, then a crisis ensues. "A crisis is the point at which it becomes apparent that what we had planned is no longer feasible and our

expectations are disrupted. The disruption can be good…or bad…but if it is a significant departure from what we expected, a crisis ensues because ambiguity enters the situation" (Conner, 1993, p. 28). This point of ambiguity is problematic for people and organizations when facing change.

Hodas (1993) described the implications of change as these pertain to the culture of an organization. He explained that when facing change, the culture of an organization is often the impeding factor in the success of the change. "What appears to outsiders as a straightforward improvement can, to an organization, be felt as undesirably disruptive if it means that the culture must change its values and habits in order to implement it" (p. 3). Thus change in an organization is measured by its implications in terms of the size of the change as well as the culture of the organization on which it attempts to transform.

In applying the implications of change to educational institutions, technological change itself is not the problem, rather it is the way that schools and the individuals in the schools respond to the change that signal whether or not the change will be successful. Technological change in education does not simply involve purchasing equipment, but rather it is a combination of the equipment and the culture of the staff and attitudes of the educators that effect positive or negative change. "But technology use is not about the hardware, Internet connections and so on. What is important is how the technology is being integrated with the instructional program" (Bennett, 2003, p. 22). Considering then, that there are greater implications that technology has on schools than businesses, it may not be a fair assessment to say, then, that schools are far behind businesses in their incorporation of technology in

education (McKenzie, 1993). Perhaps an expanded dialogue on change and the phases of change is needed to get a better understanding of change and the educator.

Phases of Change

Conner (1993) used Kurt Lewin's simple theory of change to illustrate the effects of change on individuals. His model illustrated the three phases of change: the present state, the transition state and the desired state. These phases have also been recognized in literature as: unfreezing, movement and refreezing.

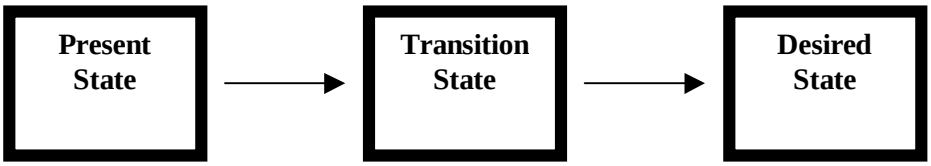


Figure 1 – Lewin's Three Phases of Change (cited in Conner, 1993, p. 88)

Conner (1993) suggested that the reason that it is so difficult for people to move from the present state to the unfreezing or transition state is that no one likes to be in a state of uncertainty or limbo. This stage is very uncomfortable emotionally and intellectually, and if individuals are pushed into the transition state, they have a tendency to want to get out of it as quickly as possible, either back to the original state (homeostatis), or to some form of the desired state. Hodas (1993) added that much of what plagues educators in the face of technology and change "revolves around the anxiety generated by their unfamiliarity and incompetence with the new machines" (p. 10). When educators face change, like the impending technological changes, if the change appears to be greater than what the educator has planned, ambiguity prevails. This may be one of the largest reasons that change movements

are abandoned too early. "Facing an inherent impossibility of understanding how [computers] work the human response has been not greater curiosity but apathy" (Setzer & Monke, 2001, p. 143). This apathy may be the result of anxiety or stress that one feels at the transition stage, resulting in returning to the original point, possibly perceived as apathy.

Individual Responses to Change

At a personal level, change has great implications on an individual. The success of change depends greatly on the ability of the individual to respond to the change. "Change implies that individuals must give up or, at least, soften their grip on their current views, practices, and/or beliefs and accept or integrate new ones in their place. The integration of new ideas rarely takes place without difficulty" (Tunison, 2003, p. 81). Conner (1993) developed a theory describing this difficulty based on the idea that a person has a certain amount of assimilation points that they can use up on stressful or ambiguous situations in a given day, and that a high level of assimilation is costly to an individual. "The high price of assimilation includes reduced intellectual energy, increased psychological stress, and diminished physical stamina and health" (p. 74). An individual's reaction to change is related to his assimilation capacity, as he adjusts to the change. Conner stated that an individual only has a certain number of assimilation 'points' to use up on shifts, changes or disruptions in a given time period, and once these 'points' are consumed, the individual is no longer able to effectively deal with disruption or change.

Conner's (1993) thoughts on assimilation illustrate why teachers resist change, especially the large changes implied by the new technology. In a given day, numerous things happen that exhaust assimilation points. In a busy day, it is very possible that all assimilation points are consumed. "[Teachers] are in a very rapid changing society. It is very stressful. People are stressed. Families are stressed…things are just coming up so quickly" (Reid, 2002, p. 39). Fullan (1998) further added that when facing technology, teachers often fail to make the effort to adapt to change because their commitment to making a difference turns to despair in the face of overload.

"People tell us that…they are juggling more tasks, more personal problems, and even more opportunities than ever before" (Conner, 1993, p. 45). This affects how well they can assimilate change. The ways that people respond to change, and the potential for ambiguity that technological change brings may combine to create great implications on the planning for change in education.

Shelf-Life Problem of Change

Assimilation to change is further compounded by the "shelf-life problem" of change. Shelf life is described as "the programs, procedures and strategies that we develop to take advantage of new opportunities or solve new problems are becoming obsolete faster than ever" (Conner, 1993, p. 45). This implies that not only do changes and their implications need to be addressed, but that the solutions are short term, and constant assimilation is required as new solutions are created to keep up with the short shelf life of change, especially those related to technology.

Technology in schools has an especially short shelf life. In a study of the use of technology in schools done by Reid (2002), a teacher admitted that "technology is moving so quickly that teachers often have difficulty keeping up to date" (p. 39). Assimilation to change and the shelf-life problem of change contribute to the complicated nature of change caused by technology in schools. It is, however, necessary to consider how individuals differ in their perceptions of the problems versus the opportunities caused by change, as will be discussed as follows in terms of resistance and resilience.

Resistance versus Resilience

Responses to change begin through the filters of one's own perceptions. If one perceives change to be great and unwarranted, the individual will be more likely to resist that change. In the words of Connor (1993) if change is perceived to be large, change absorbs more assimilation points, thus is not likely to happen. However, if change is perceived to be smaller and necessary, it would absorb fewer assimilation points and will more likely occur.

Resistance and the individual. "Many people have learned to accommodate the stress of increased change by reducing their expectations for success" (Conner, 1993, p. 52). This implies that when faced with change, some individuals, rather than attacking it and expecting positive outcomes, will settle for mediocre results in an effort to cope with the ambiguity. Hodas (1993) attributed part of this reduced expectation for success to "the very real need for teachers to appear competent" (p.

11). Thus if expectations are set at a low level, goals are met and feelings of competency are restored.

Conner also warned that resistance to change occurs both overtly – when resistance is made clear, and also covertly – when quick fix cover-up solutions are used to create an appearance of change, masking the reality that change has not really taken place. Either way, if individuals resist change, either because of the change itself or the implications of it, it is difficult to realize the change.

Resilience and the individual. The previous sections paint a picture of a dull, change resistant institution. However, it is important to also acknowledge those individuals in institutions who welcome challenge and opportunity and do not run in the face of ambiguity.

Conner (1993) terms these individuals as resilient people. Resilient people are those who can handle great change and the uncertainty and implications that come along with it. They "face no less challenge than others when confronting a crisis, but they typically regain their equilibrium faster…" (p. 65). These individuals consume fewer assimilation points with change because they understand how change affects them. "The main ingredient of success is the ability resilient people have to understand and use to their advantage the principles underlying basic human patterns that operate during change" (p. 57). These individuals realize that there is no time to waste fearing change, and that it is not feasible to retain the status quo.

Fullan (1993) linked resilient people to those having a moral purpose. He stated that, "those skilled in change agentry appreciate its volatile character, and they

explicitly seek ideas for coping with and influencing change toward some desired ends" (p. 2). It is important to note at this time that in educational institutions, change is not simply a matter of resistance or resilience, rather that it encompasses aspects from the environment as well as aspects of self-efficacy, which will be discussed later in this chapter.

Organizational Responses to Change

At an individual level, the way that change is managed is an outcome of products such as perceptions, environment and self-efficacy. At an organizational level, the way that change is managed depends on how the organization is structured as it tries to absorb, modify, or completely transform itself to incorporate that change.

The way that change is introduced at the organizational level may have a great impact on how change occurs in the organization. Bennett (2003) explained that "over the last 20 years, K-12 schools have spent millions of dollars equipping their schools with the latest technologies, but often without a thoughtful plan…" (p. 22). Slowinski (2003) added that there must be plans in place to support the influx of technology in terms of its implementation, and that ensuring access is not enough. More emphasis must be placed on implementation and long-term planning.

Although steps can be taken in terms of vision and goal setting, Salisbury (1996) provided a theory for proposing change in an organization using his work of systems theory. Systems theory is a framework for approaching and implementing successful change in an organization. In general, systems theory may be understood as the idea of viewing an organization as a whole, rather than addressing it in its

simpler parts. This theory recognizes that all parts work better as a whole, and that a change in one part of the organization results in change in another.

McKenzie (1993), looking at systems theory, reasoned that schools who are not working with a systems theory philosophy often have two approaches to coping with major changes. The first is that the school chokes off the change by ignoring it, since facing the change may threaten the balance of the organization. The second approach is the opposite. Instead of ignoring it, the school takes on the change, gets overwhelmed by the change, becomes internally imbalanced, and performance suffers. Hodas (1993), when describing school organizations, stated that "their goal is not to solve a defined problem but to relieve the stress on the organization caused by the pressure operating outside of or overwhelming the capacity of the normal channels" (p. 2). Like McKenzie (1993), Hodas (1993) is implying that without a plan, an organization may respond to change using a coping strategy that minimizes the impact of the change on its personnel, seeking not to improve itself, but to merely survive the change.

Salisbury (1996) formalized his systems theory and identified steps to follow as the change progresses from the center of the organization and moves to all parts. Salisbury illustrated that a change in one area of an organization affects all other areas of the organization. He emphasized that systems theory is a rational way to solve complex human problems by focusing on the idea that no action is unilateral in its impact, and that system theory is related to all parts within and outside the organization. Slowinski (2003) echoed Salisbury when he stated that "[schools] must

develop strategies to sustain technology…while taking into account the *total* cost of ownership [italics added]" (p. 26).

In studying organizational change, Conner (1993) agreed with Salisbury's (1996) theory in that when implementing change, consideration of the effects on all parts of the organization must be considered, and proper communication to all parts is vital. Conner (1993) stated that organizations can be classified as winners (resilient) and losers (resistant). The difference in winners and losers is that "much of our problem with making organizational or macro changes is that we fail to adequately communicate to people the impact these decisions will have on them personally. No wonder these kinds of changes are difficult to enact" (p. 81).

Assessing the perceptions of change on the individuals within an organization is also vital. Conner (1993) recited a story about Thomas Edison and his invention of the light bulb. In his efforts to have society accept the invention, he shaped it and installed it in the same way that gas bulbs were used. He took great pains in making sure that it appeared as closely as possible to the gas lamps that they previously used, so that the invention was familiar and comfortable to them.

Organizational change management has to do with managing perceptions of change, and listening and understanding the needs, concerns and realities of the individuals on which the change will have an effect (Conner, 1993). It is also the duty of the organization to make sure that challenges and capabilities are matched in order to reduce resistance to change and lessen associated ambiguities. In paralleling this duty to schools, Slowinski (2003) emphasized that implementation must be done

with a vision, but also with an assessment of the environment and existing conditions so that effective strategies can be mapped out.

The implementation dip. Fullan (2002) identified an important phase which occurs after a change takes place in an organization as the implementation dip. This is the period of adjustment after a change implementation when successes are yet to be realized. This time is often an uncomfortable period and is the reason many institutions abandon change too early. This period would be classified as part of the 'anxiety' stage of Lewin's (cited in Conner, 1993) early model of change. Fullan (2002) cautioned us to "appreciate the implementation dip. Leaders can't avoid the inevitable early difficulties of trying something new…no matter how much they plan for change, the first six months or so of the implementation will be bumpy" (p. 18). If the implementation dip is an expected and planned stage of change, the tendency to succeed will be higher.

In an organization, it is important to understand the implementation dip and to allow individuals the time and the support needed to accept change. Figure 2 is a diagram indicating the stages of change commitment, illustrating that unless the stages are understood, change may be abandoned too early, before institutionalization and internalization take place. This diagram is helpful in understanding the implementation dip, since it illustrates what people most likely experience during change, and is a reminder that change takes time and involves various phases. The vertical axis indicates the degrees of support for the change, and the horizontal axis indicates the amount of time that someone has been exposed to the change.

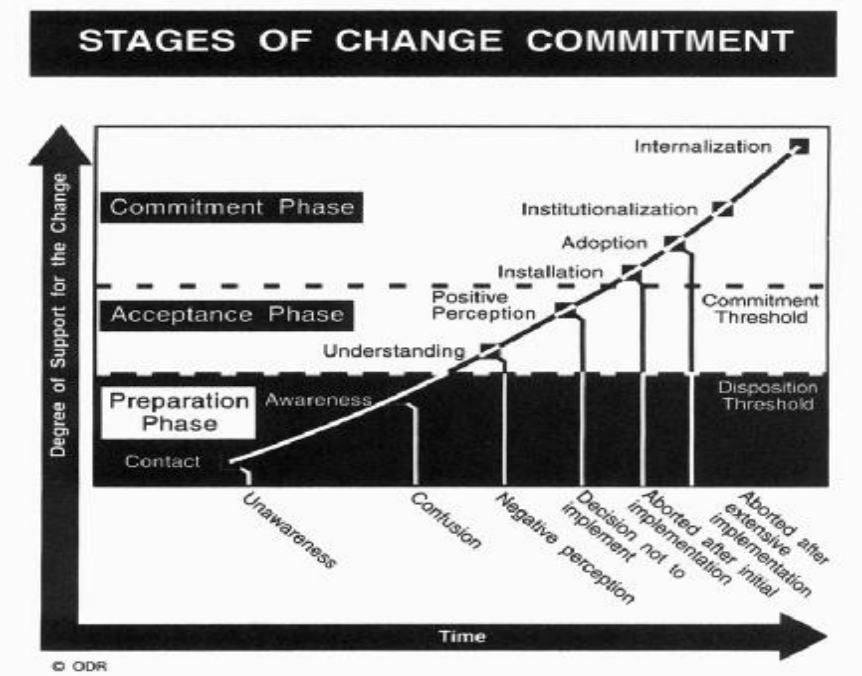


Figure 2 - Stages of Change Commitment (in Conner, 1993, p. 148)

As an example, consider a school implementing a policy, which states that all teachers intending to send communication home to parents must have it approved by a new communications liaison in the school. In Conner's (1993) figure 2, there would be three phases to this change: preparation, acceptance and commitment. Using this example, in the first phase, contact would be made to all staff and they would either become aware of the change, or remain unaware. This would then lead to understanding or confusion, depending on the message and the receiver. The level of understanding the change would either cause members of the staff to be well-prepared or ill-prepared for the next phase of change, which is the acceptance phase.

In the acceptance phase, the staff would develop an understanding of the change (at different rates), and in this case, would start to approach the liaison with

communication memos. Depending on their experiences, they would develop either positive or negative perceptions of the change, and may continue to use the liaison, or be resistant to the change. Negative perception would keep the degree to implement at a low level, and, of course, positive perceptions would prepare the staff for the next phase – the commitment phase.

In Conner's (1993) view, the commitment phase includes the installation, adoption, institutionalization and internalization of the change – the committed belief in and use of the communications liaison. It is in this phase that change would become long term and part of the organization, and, although the change may still be aborted during the installation and adoption stages, this would be because it was an ill fit to the organization, rather than because of resistance to change. Once the commitment would reach the institutionalization and internalization phases, it may no longer be considered "change" because it would be part of the organization. In this example, the liaison would be a natural part of the school, accepted, used and required for the staff to function normally.

The future shock of change. Conner (1993) described the dangers of organizations having to absorb too much change too fast. He referred to this as future shock, stating that "future shock occurs when people are asked to absorb more disruption than they have the capacity to take in" (p. 51). If this occurs, it is possible that a valuable response to change is impossible, and it results in stress and an inability to adapt to change.

Conner described that future shock also results in missed opportunities for success, as organizations must then only pick and choose which change initiatives they will engage in. This may mean missed opportunities for the organization, and, in the case of education, missed opportunities for the students.

Future shock and self-efficacy are linked as well. As will be discussed later in this chapter, if an educator feels that it is possible to effect positive change, he/she will be more likely to commit to change, but if the educator feels that valuable change cannot be effected, the commitment would most likely be lower, and opportunities may be missed.

Inadequate response to change is costly. "The quality of life for not only the next twenty years but for future generations depends on what we have accomplished today" (Conner, 1993, p. 52). If poor responses to change are not addressed, stress, anxiety and frustration increase and opportunities are missed. Conner used the metaphor of a saturated sponge to describe an organization's ineffective response to change. "Although already soaked, someone walks in with another two-gallon pitcher of major change and pours it on them" (p. 56). Regarding change as an opportunity rather than a stressor will promote effectiveness and opportunity in the organization.

The Reality of Change and the Educator

Faced with the increasing expectations arising from technology, educators are scrutinized as to how they approach this technology sweep, and according to some scholars, educators are not making the grade. "Negative report after negative report

claim that schools are failing to prepare students for this turbulent and surprising world, but educators seem seriously divided and confused over how to respond" (McKenzie, 1993, p. 2). McKenzie argued that educational reform is weak, and that members of educational institutions from board members and superintendents to administrators and teachers rely on traditional planning to strategize for technological change. He remarked that "old ways of educating children are increasingly inadequate and irrelevant" (p. xi) and that "old paradigms…shape the thinking and the planning" (p. 22). To succeed, planners need to think a decade ahead and envision what education will look like then, and completely change thinking and planning to truly embark on a journey of change.

Salisbury (1996) affirmed these views and also implied that the classroom is actually obsolete and in desperate need of reform. Salisbury noted that "what is needed is to transform our current education system into a totally different kind of enterprise" (p. 4).

More recent literature, although positive, is conservative in its acclaims of gains made in education regarding the incorporation of technology. "Many of the major institutions in our society have changed [because of technology]…However, the impact on education may be just beginning to be felt as teachers integrate new technology into their teaching" (Reid, 2002, p. 30).

Fullan (1993), in his work on teachers as change agents, discussed how a change is needed, but that the change should focus from the teacher to the institution. "On one hand, schools are expected to engage in continuous renewal, and change expectations around them…On the other hand, the way teachers are trained, the way

schools are organized, the way the educational hierarchy operates, and the way political decisions makers treat educators results in a system more likely to retain the status quo" (p. 2). Bennett supported this, when he stated that "staff and community, districts and schools must develop a thoughtful technology plan" (p. 23).

Clearly, educators and their institutions are questioned as to their response to this change and to their attempts in creating effective technologically adapted teaching and learning practices. No longer are the traditional methods for teaching and learning universally applicable.

> The implication for educators is clear – we must rethink most of our existing educational paradigms, for they are based on views of society that are no longer valid. Students must be prepared to accept, adapt to, and thrive upon change. The process of education must deal with the needs of students to develop both macro and micro strategies for dealing with their world. (Tsantis, 1991, p. 142)

Cuban (1996a) argued, however, and stated that schools have effected great change over the years, but that "this myth about public schools seldom changing is due, in part, to amnesia about the capacity of schools to transform changes into stable routines" (p. 75). These existing oppositions will be studied as they are presented in literature in the following section.

Effective Educational Practices – Technological versus Traditional

Is education in need of large scale revamping and transformation? According to several scholars, the education system has left itself far too long, operating in ways that are not in sync with today's technology and society, and is in need of great change (McKenzie, 1993; Salisbury, 1996; Setzer & Monke, 2001; Tsantis, 1991). Still, according to others, full implementation of technology in education without careful planning is both dangerous and foolhardy (Armstrong & Casement, 1999; Auer, 2001; Hewitt, 2000; McNeil, 2000; Rothenberg, 1998). The following section outlines the pros and the cons of technological reform, and provides details to these claims.

Technology in Education Gets Top Marks

There has been much discussion around the issue of technology and its benefits to students. Arguments for the use of technology are numerous throughout this literature review, and can be summarized in categories such as delivering higher student achievement, motivating learning, assisting in special needs education, improving attitudes toward school, and freeing teachers to allow for more one-on-one time with students (Berge & Mrozowski, 1999).

Many researchers maintain that computers, when used properly, can improve students' performance or make them more confident learners. (Breuleux, 2001; Schofield, 1999; Tapscott, 2001). Tapscott went on to state that computers have actually taken children away from the TV to doing activities that involve search, reasoning and self-learning. "When they are online they are reading, analyzing,

authenticating, contextualizing, sorting the digital wheat from the chaff, composing their thoughts [and] criticizing" (p. 4). The promising features of technology are discussed below as they pertain to motivation and to alternate, more effective teaching strategies.

In his research on the uses of technology in schools, Reid (2002) studied a group of teachers who believed that technology has changed education for the better, that it facilitates resource-based teaching, and that it changes the teacher-learner relationship to one where "the relationship between teacher and learner is sometimes reversed with regard to information technology (p. 36). Technology has also influenced education in a motivational capacity, as well as changing the face of instruction delivery.

Technology as a motivator. Computers in education are known to be a great motivator. Walk into any school and watch younger students as they romp into the computer lab, ready to use the tools in a variety of ways. Stiff-Williams (2002), a principal with great interest in engaging students in teaching and learning, reported:

> Routine use of computer technology…is a medium in which most students appear to possess incredible proficiencies. Opportunities should be abundant for students to use computers for learning, including opportunities to conduct Internet searches, prepare papers and projects, and daily homework assignments, and complete tests and tutorials for basic skill development. (p. 20)

One area where computers have been a great motivator is in environment simulation. In this facet, computers provide students with learning opportunities that they may otherwise never receive (Hewitt, 2000). Whether it is in studying the atmosphere, the solar system or the bottom of the ocean, undoubtedly, computers can provide a motivating and unique opportunity for students to learn in ways that the classroom teacher may not be able to provide.

Warschauer (1996) summarized the motivators for using computers as the novelty of the new medium, its individualized nature, opportunities for learner control and the opportunity for rapid feedback. All of these facets frame computer technology assisted instruction as an exciting venture for the teacher and student.

Technology as a teacher. Tapscott (2001) elaborated on the idea that technology shifts instruction from a focus on the teacher to a focus on the learner. This learning is based on interactive learning, rather than the traditional linear learning. Learning also goes from instruction to construction and discovery, and from a one-size-fits-all to customized, lifelong learning.

Wang (2000) agreed, highlighting the benefits of multi-media, student focused lessons. Wang concluded that, "information technology in education clearly is an incredible resource and will, without question, continue to be the single most important component of 21st century education" (p. 34).

Much like Edison predicted in 1922 (Hewitt, 2000), technology was predicted to be a way to distribute the most effective and meaningful lessons to a larger audience so that each child is receiving the best of the best. Adding to this are the

ideas that Keenan (2000) suggested, having teachers teach each other by contributing to learning repositories, so that the best lessons can be shared and delivered to all students. "Why should we care about learning repositories? Because they take…object reuse…and apply it in the critically important and under-funded area of education and training" (p. 2). Keenan suggested that great ideas should get passed around so that students can learn the most, in one of the best ways.

Countering these optimistic views are those of Armstrong and Casement (1999) and Hewitt (2000), who stated that sitting a child in front of a screen is no guarantee that he will learn. What is still more important is what is done with technology to tap into the interests and maintain the attention of young learners. Even after developing CAI (computer aided instruction) modules to use the computer as a tutor, "decades of research have been unable to prove that CAI produced better results than traditional classroom teaching (Hewitt, 2000). The main difference may be that computers are unable to effectively diagnose and respond to student difficulties, thus possibly greatly reducing the threat of ever replacing teachers in the classroom.

Technology and on-line learning. On-line learning opportunities, also termed distance education, are becoming more available for children and adults. Classes are offered provincially, and in some areas, through local school boards. The attraction is learning from home, on your own, and at your own pace. Some even realize benefits through feeling a lower competition level, and a safer environment. As an example, consider this comment from a teacher using a system-wide

technology driven math program with middle years students: "Girls who might feel uncomfortable in math or intimidated had the opportunity to progress at their own pace" (Sheppard, 1998, p. 2).

An area that computers have been effective with is drill and practice operations, whether on-line or in the classroom. Barring arguments as to whether or not drill and practice is a valuable teaching strategy, computers are ideal for this application of programmed instruction (Hewitt, 2000).

On-line learning has also provided students with tremendous research opportunities. Information is readily available to students on the web, enabling quick access and opportunity for research and presentation. Hewitt (2000) outlined the benefits of web access, but also noticed problems when he observed a class who was doing web research. He stated that the information might have been at the students' fingertips, but that the students had to sift through vast amounts of irrelevant material, therefore "little time was spent on underlying content" (p. 35).

Interestingly however, studies have indicated that when statistics are broken down, there is 'no significant difference' in performance of students doing on-line courses versus traditional classes (Meyer, 2003). What Meyer did find, however, is that there are improvements in performance levels when traditional teaching is combined with technology and on-line learning. These results also indicated that, "student learning also may depend more on individual characteristics, such as positive attitude, motivation, independence, and computer skills that ensure learning is not just a passive experience" (p. 2). It is not just comparing one or the other, but finding the right combination that is key.

The Darkside of Technological Reform

With all of the promises and predictions of the benefits of technology in education, there is also a substantial body of writing arguing the downfalls of technology in schools, its misuse, and its inappropriateness.

Those individuals who tend to oppose technology and propose that it often causes more problems than benefits are often termed or self-termed as luddites. "Educational researchers have consistently identified teachers who question the efficacy of educational reforms as Luddites…ignoring the perspectives of teachers who are justifiably cautious about technology" (Judah, 1999, p. 18). These Luddites argue that for reason of pedagogy, technical problems or other issues, computers have only a small place in schools.

Cuban (2000) argued that there is "no body of serious research to measure whether technology will achieve its own goals – whether it can help in areas such as intellectual development" (p. 1). He further commented that, "…there is a conflict of values between techno-enthusiasts and teachers who are comfortable with the human role they have become used to playing without the machine to interfere" (p. 3). Cuban also pointed out that additional problems arise when teachers themselves don't agree, or when the technology initiatives are top down, coming from people who don't understand the teacher's needs in the classroom. "What are the goals of schooling? Do we care most about literacy? Social Development? Other goals? The school community needs to reach a consensus" (Cuban, 2000, p. 3). Then and only then should technology strategies be considered.

Reid (2002) revealed a group of educators' concerns about the use of technology through his research. Educators researched indicated that maintenance requirements, the potential for information overload, the pace of change and stress, and the time involved were some of the issues that prevented them from embracing technological change. The discussion that follows includes these ideas, as well as the pedagogical issues that may accompany the incorporation of technology in schools.

Pedagogical difficulties. Armstrong and Casement (1999) argue that when students sit in front of computers, other things change that "affect the child's perceptions of knowing and doing" (p. 28). They state that the computer takes the focus from careful consideration to immediate action; a careful formation of ideas to a buildup of knowledge; from three-dimensional reality to a two-dimensional virtual reality. This has issues in terms of learning.

"Putting a child in front of a radio or television [is] not a guarantee that learning will occur" (Hewitt, 2000, p. 33). This implies that teachers must be there to ensure that students are engaged and that lessons are suitable. Nelson (2001) echoes, affirming the following:

> A constant stream of information provides no instruction on how to apply, rank, and judge [data]. Instead these things are learned in relationships, as a child begins to fathom the teacher's viewpoint, and through that learns to interpret and order the information he or she aggregates. (p. 38)

These relationships may be difficult to attain in a classroom where the children are poised in front of machines, immersed in a world of pseudo-realities.

Problems with development and learning. Technology as a motivator is a great asset in education, but looking at this issue from a developmental angle, one wonders if the early application of technology in education is valuable or whether the downside of it is too costly.

> In schools…we appear to be creating an environment that mirrors the fast-paced adult world, in which time, productivity and instant communication are of the essence…[but] schooling, particularly in the elementary grades, should allow children the time to think and wonder and get to know themselves in the real world they live in. (Armstrong & Casement, 1999, p. 28)

The computer also presents a danger in that it becomes a substitute for emotional and intellectual bonds that children so desperately need. Educators and parents must be careful about how much technology interferes with early learning. The use of computers requires careful thought, planning and "pedagogically sound teacher-organized activities" (Hewitt, 2000, p. 36). Koblitz (1996) agreed and provided an example regarding the activities that children require during the day, stating that "… children benefit from most material that stimulates them to exercise their imagination. For example, simple, unstructured play material like clay, sand, blocks, rag dolls, and finger-painting sets are more wholesome entertainment than TV…" (p. 3).

In the words of Johnston (1999), schools as we know them are here to stay "because children must be brought together to learn some things which can only be learned together" (p. 2). Hewitt (2000) supported this when he said "any approach that physically isolates students is educationally questionable, and probably developmentally harmful" (p. 36). These proponents are reluctant to accept that the benefits of technology in education may outweigh the costs.

Unequal opportunities. Another important issue to consider is the fact that computers are found in many homes of those considered the "haves" and are not as common in those homes of the "have-nots." This creates a larger gap between socio-economic classes evolving into different opportunities for different students (Tuinman, 2000), an effort contrary to social policy of equal opportunity for all students.

Computers can also put great financial pressure on parents who, of course, want the best for their children.

> It is regrettable that computers have been so aggressively marketed to teachers and school systems…many company sales representatives have taken the hard-sell approach [saying that] if you don't buy [the computer company's] latest products, you will be neglecting to prepare your children for the 21st century. (Koblitz, 1996, p. 7)

In a study on the use of computers, Cuban (1996b) found that "uneven access means that individual students who use computers [and not all do] spend one to two hours a week on the machine" and that "students from high-income families have far

more access to computers in schools than peers from low-income families. Minority students and those whose native language is not English use computers in schools less than their classmates do" (p. 2). This access results in a large variance in results of computer use in schools and raises questions about the equality of education across the nation.

Abandon the good for the uncertain? Teachers face many demands with introducing new curriculum, buying into new paradigms and responding to individual student needs. Add to that the task of classroom management, and teachers have a full plate. Reliance on trusted texts and resourceful libraries are often certain elements that provide sound practice to a teacher's education delivery plan. Technology, however, adds another element to this mix. Cuban (2000) relayed this reality:

> Suppose you're a high school teacher. You have five classes and a few prep periods. You teach about 100 kids a semester. You have papers to grade, homework to assign, tests to prepare. You're told you have to use the computers but you also have to follow the curriculum and what if the two don't match? What if the computer breaks down or there's only one to be shared by all students in the room? If there's a lab, you need to schedule time to use it. And the technology is neither reliable or flexible enough for you to count on it. Elementary school teachers have a similar problem. They have fewer students but even more subjects to cover and very little time to prepare. (p. 2)

These dilemmas are common among classrooms across the country and include issues of reliability, content control and appropriateness. In the words of Roszak (1997), with a class on the Internet:

> If teachers can get the kids beyond the advertising and ask them to learn about, say, Aztechs, the search engine may produce on the order of 45,000 "hits"…everything from soccer teams, used tire companies and disco clubs to bowling alleys and software firms…there is no quality control as there would be in a school library. (p. 12)

In these cases, teachers often are pushed toward technology because everyone else is doing it, rather than work with what students need. "Over the generations, teachers have evolved skills to encourage a respect for quality, truth and good taste. I'm not sure I understand why we should, at the behest of entrepreneurial elements, now decide to retire those skills in favor of "Yahooligans" (Roszak, 1997, p. 12). This is evidence, again, that educators may be reluctant to abandon teaching practices that have delivered competent graduates for new methods without certain results. "It is important that teachers and students use the new technologies for their unique attributes and not in ways that replicate what face-to-face teaching can do as well, or better" (Fraser, 1999, p. 38).

No time to teach. Often technology itself becomes one of the largest down-time creators in the school day, making teaching and learning an impossibility because of a reliance on the equipment. Auer (2001) recalled a time when he asked

his son what happened in school that day, and his son described a situation in computer class:

> Unfortunately, much of the first half of the class time was spent trying to figure out why the computer had caused an almost instant power outage. The problem was eventually traced to the school's circuit breakers. Everyone thought the class could proceed, although with only three computers for 24 students, meaning that the remaining 21 had to gather around the computers or find something else to do. Unfortunately, the second computer blacked out. Finally someone discovered that the power bar had been pulled out of the wall, but when they plugged it back in, it still didn't work. After much commotion and time delay, it was found that the switch on the power bar had been triggered by someone's foot. By now, these computers had consumed most of the class time. (p. 6)

Auer argued that he works with a computer all day, but doubts their usefulness in the classroom until the students have to learn programming skills. This is in line with just-in-time technology, the idea that technology is introduced only when the students need it. He continued by stating that obsolescence, costs, maintenance, software maintenance, software filtering issues, and license fees are reasons to legitimize why computers are not a good fit for the classroom.

Along with indicating that there are technical issues with bringing computers into schools, Auer stated that students also suffer academically. Their typing skills

suffer from a hunt and peck approach, they rely on spelling and grammar checkers, they become dependent on the instant gratification that the computer supplies, and they place a larger value on the authority of the Internet than on their own skills of reason or source evaluation.

Rothenberg (1998) insisted that "instead of becoming perfectionists, too many students have become slackers, preferring to let the machine do their work for them" (p. 60). He also admitted that he "needs to teach students how to assess sources to determine their credibility, as well as to trust their own ideas more than snippets of thought that materialize on a screen" (p. 60), reinforcing that students often attribute too much authority to the internet, failing to become the readers and judges of information that they need to be.

The promise that technology has the potential to be a great time saver in education falls short in its delivery. Hewitt (2000) explained that although computers can be used for delivering instruction, word processing, drill and practice, simulations, and web browsing, they, in themselves, are not pedagogically sound. Rather, they only "*complement* pedagogically sound, teacher-organized activities. Such applications do not reduce or offload any of the teacher's work – in fact, they often increase it…" (p. 35) [emphasis added].

The time that teachers have in a day to deliver the instruction that they are required to deliver is consumed in a variety of ways. It may be reiterated that it is vital that teachers quickly assess and use the methods that work and that match the needs of the students so that time and efficiency are maximized.

Costs. Along with educational, developmental, and time-consuming costs, there is a large financial ticket to the incorporation of technology in education. Along with purchasing the machines and the software, there are professional development fees, substitute costs, power, cooling systems, alarm systems and more that are all a part of the investment in technology. Perhaps this money could be better used for education rather than equipment. "Teachers…need opportunities to upgrade their qualifications, to learn about different teaching materials, and to interact with other teachers as colleagues. This requires release time, light teaching years, or sabbaticals. If money currently used to buy computers and software were instead devoted to improving conditions for teachers, it would be money well spent" (Koblitz, 1996, p. 3). This implies that perhaps less money ought to be dumped on technology alone, and more on the professional development that must accompany the technology to ensure greater success, or on more teachers or books to support traditional learning (Reid, 2002).

Just-in-Time Technology: Another Option

As mentioned earlier, skeptics of technological educational reform propose the idea of the "just-in-time" delivery model of technology in the classroom. This appears to be a 'neo-Luddite' way of thinking, since those advocating its use believe that technology can be introduced just when students need it (McNeil, 2000). As students recognize the need for computers or technology as a support for their learning, the teachers would be able to provide it. Hewitt (2000) responded to this option when he stated that although technology is a time consuming venture, he

admitted that if computers are used as a complement to pedagogically sound teacher-organized activities, that "they do provide richer learning experiences for students" (p. 35). He warned, though, that the technology should only be used when needed, and that "less successful applications tend to be the ones in which the computer assumes some of the teacher's duties" (p. 35).

This literature may imply that the school is left to determine the most effective use of technology. Perhaps technology in the schools will never appear to be as vastly used as it is in the business world. Perhaps this is for a reason. Hewitt (2000) predicted that in the future, computers will continue to be used in schools to provide parents with greater access to their children's work, mentoring services through e-mail, and specialist visits through audio-visual link-ups. This future will also be one "in which effective teachers are more necessary than ever" (p. 36). As predicted by Hewitt, the future will involve more just-in-time technology than a blanket approach, where technology time-efficiency and cost-efficiency may be maximized.

Self-Efficacy

The following section describes the notion of self-efficacy, as identified by Bandura (2000). Self-efficacy is relevant to the research question in that an educator's belief in him or herself to effect change in education may determine how one applies him or herself to that change. "Perceived self-efficacy refers to the beliefs in one's capabilities to organize and execute the courses of action required to produce given levels of attainment. Unless people believe they can produce desired effects by their actions, they have little incentive to act" (p. 18).

Fraser (2001) emphasized that educators are greatly influenced by self-efficacy when she stated that for educators, "the most powerful motivator in one's professional life is one's own responsibility for each child's success and well-being" (p. 50). Fraser took this a step further and asserted that if "teachers are sometimes considered too stuck in [their] ways, unwilling to adapt to change, too critical of innovation, and slow to get on side, it may well be because in [their] hearts and minds [they] feel torn between pedagogic accountability to children, and political accountability to a public agenda…" (p. 50). Fraser's powerful statement triggers thoughts as to how powerful self-efficacy is in motivating individuals to change or to resist change, thus is worth further exploration, as Bandura (2000) originally theorized.

Self-Efficacy and the Educator

Bandura (2000) stated that perceived self-efficacy contributes to motivation and performance accomplishments. He divided self-efficacy into four areas in which self-efficacy regulates human functioning. These areas are cognitive, motivational, emotional, and selection processes. These four processes imply that self-efficacy affects an individual in four different areas, to produce a behavioral outcome.

Cognitive processes. Thought patterns can undermine or enhance performance; therefore, "the stronger the perceived efficacy, the higher the challenges people set for themselves and the firmer their commitment for meeting them" (Bandura, 2000, p. 19). Bandura theorized that the cognitive element of self-efficacy

affects the level of mental determination that an individual has toward completing a certain task. Translated to education, an educator may commit to a certain task, thus has a cognitive desire to get it done, therefore, the desire to achieve the goal will be a driving force to actually attaining it. Colloquially, this might equate to the notion of doing what one says they are going to do. It is a mental commitment to completing what one sets out to do.

Motivational processes. Bandura (2000) emphasized that efficacy plays a large role in motivation through anticipating outcomes of behaviors. "Once people commit to valued goals, they seek self-satisfaction from fulfilling them and intensify their efforts by discontentment with substandard performances" (p. 20). If a behavior is expected to produce a desired outcome, the behavior is likely to be exhibited until a desired outcome is reached. In contrast to cognitive self-efficacy, where the task is completed because of the understanding that one must do so, the motivational component of self-efficacy insists that the driving force lies in the excitement of feeling the self-satisfaction in attaining the goal.

Emotional processes. Bandura (2000) explained that there are emotions that are elicited when one embarks on a challenge and strives to complete the challenge. Also termed 'effective processes', emotional processes refer to the stress and depression that people experience in taxing situations. "People who believe that they can manage threats are not distressed by them. People who believe they cannot control them experience high anxiety" (p. 20). Bandura stated that the emotions that

taxing situations bring about cannot be avoided, thus the emotional processes of self-efficacy could be a reason why educators choose not to get involved in additional tasks. Avoiding these emotions is key, and a way to do so is to avoid being involved at the outset.

Selection processes. Beliefs of self-efficacy play a role in shaping one's life by helping people determine what they get involved in. Bandura (2000) pointed out that "by choosing environments, people have a hand in what they become" (p. 22). Bandura emphasized that people who have a low sense of self-efficacy shy away from tasks that they perceive to be difficult or in which they predict failure, but those with a strong sense of self-efficacy approach difficult tasks with a sense of challenge and commitment, and avoid early rejection or abandonment.

Echoing Conner's (1993) work in resilience, Bandura (2000) noted that a resilient self-belief allows people to overcome repeated early rejections of their work and that self-efficacy is reflected in their innovative, sociable, and non-anxious work.

Fullan (1993) introduced the ideas behind self-efficacy when he suggested the link between moral purpose and change agentry.

> Moral purpose…concerns bringing about improvements. It is, in other words, a change theme…moral purpose keeps teachers close to the needs of children and youth; change agentry causes them to develop better strategies for accomplishing their moral goals. (p. 2)

Although this statement emphasized change, Fullan also described the link between an educator perceiving that he can make a difference, and his motivation to create a better learning environment for his students.

Bandura's (2000) work on self-efficacy, although presented in brief, may assist to explain the mental and emotional processes that individuals undergo when faced with environments that introduce change and uncertainty. This is such for the educational environment, thus Bandura's theory might aid in the understanding of the personal side of the introduction of technology in education.

Self-Efficacy and the Organization

An organization can also reflect efficacy, but this is not a mere collection of individual self-efficacy, rather it is a reflection of the attitudes of the group, its performance and its perceived successes.

> People's shared beliefs in their collective efficacy influence the type of futures they seek to achieve; how well they use their resources; how much effort they put into their group endeavor; their staying power when collective efforts fail to produce quick results or meet forcible opposition; and their vulnerability to discouragement. (Bandura, 2000, p. 25)

This collective self-efficacy has a strong influence on the success of organizational change, and is vital for successful functioning.

Sergiovanni (2000) pointed out that teachers, central to the success of a school, must feel a sense of efficacy in order to create a purposeful learning

environment. Without a sense of efficacy, motivation and commitment drop. Their sense of efficacy is dependent on the level of support that they receive, their level of professionalism and accountability, their opportunity to contribute to decision-making, and the collegial culture of the school. "Efficacy means having the power to produce a desired effect" (Sergiovanni, 2000, p. 132). By forcing decisions and change on educators, this sense of efficacy may be diminished, resulting in a lack of success. Sergiovanni presented a diagram to illustrate the connection between different professional teacher elements and professional efficacy, reproduced here:

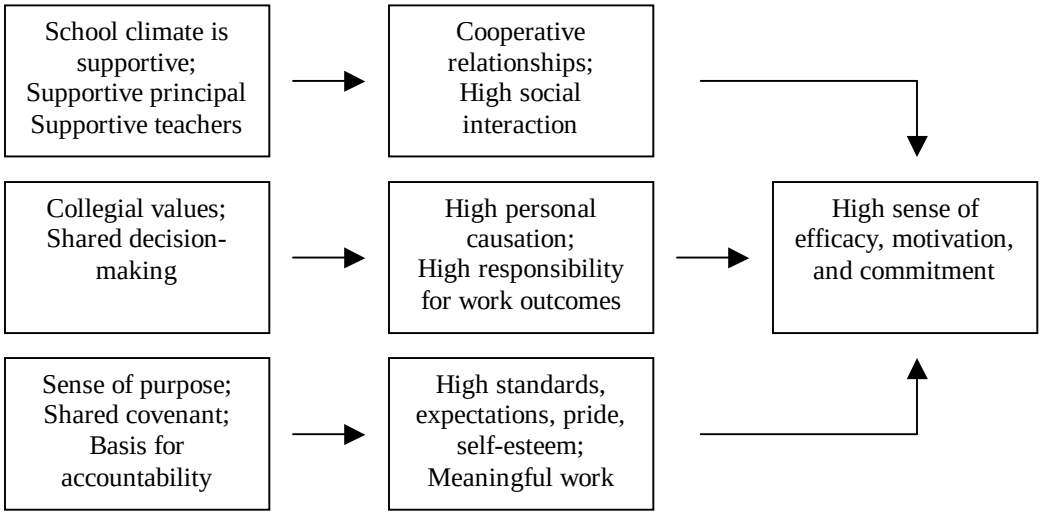


Figure 3 – Professional Efficacy (Sergiovanni, 2000)

Fraser (2001) described that much of the problem with self-efficacy and the institution is that employees are often drawn to seeking answers up the hierarchy when effective organizational self-efficacy should really direct educators to "look back to the children and to [their] own sense of responsibility to them" (p. 50).

Self-efficacy plays a major role in technology and education today. "Modern life is increasingly regulated by complex technologies that most people neither understand, nor believe they can do much to influence" (Bandura, 2000, p. 27). It is through collective self-efficacy that organizations might succeed in achieving successful technological change, and through individual self-efficacy, that educators might not only survive, but might thrive in this technologically inclined world.

Current Technological Conditions in Educational Systems

Sergiovanni (2000) reminded us that it is a mistake to presume that a new initiative should lead to a change. He stated that starting backwards doesn't work. "Instead of form following function, function begins to follow form" (p. 124). The knowledge of teachers, their empowerment, and the support they receive is what leads a school to success. Therefore, a discussion on related literature pertaining to the educator and the conditions in which he works is both relevant and necessary.

The Institutional Nature of the School

Even though our nation's teachers are responsible for preparing our students for a technology driven society, the nature of the institution is often a very large obstacle in educational reform. "Schools as workplaces are hierarchical in the extreme, with a pyramidal structure of power, privilege, and access to information…At the bottom, in terms of pay, prestige, and formal autonomy are teachers" (Hodas, 1993, p. 3). Through this, Hodas suggested that it is the structure of the institution itself that prevents improvement reform.

Cuban (2000) had similar views when he discussed technology initiatives. "Most technology initiatives are top-down. Many teachers want to use the technology but others don't because the people who make the decisions don't understand their needs" (p. 2).

Along with hierarchical structure is the idea that planning for technology often includes the cost of the equipment, but not the costs of the training associated with it. "School technology planning seldom includes the additional costs required for professional development …that teachers need to effectively use the new systems" (Thompson, 1999, p. 11). Most professional development, according to Thompson, comes in the form of how to operate the technology rather than how to integrate the technology. Keenan (2000) agreed, and noted that "training and professional development are key issues for stressed-out teachers who don't have time to add technology worries to their other problems" (p. 17). This implies that educators are not given the resources or time necessary to formulate and implement real change, and that real instruction, time and resources are needed for collaboration and content development.

"Educators need the time, the resources, and the permission to re-invent the meaning of schooling - time to work together to dismantle the mind-numbing hardware of the Industrial Age…they must be restructured" (McKenzie, 1993, p. 42). What an impact this would truly have on learning organizations. Gone would be the one-shot deal in-service days of portfolios, assessment, computer-in-the-classroom strategies, and other developments. Instead what would be seen is a collaboration of educators, businesses, organizations and technological equipment to reach far beyond

the walls of the school, working to create a societal education, capable of preparing students for life beyond grade 12.

The Systemic Nature of the School

McKenzie (1993) argued that the isolated nature of each system in schools prevents educators from asking what change new technology implies for the larger system as a whole. Unfortunately, far too often, decisions are made in schools at the department levels, meaning new maps for social studies, novel sets for language arts, or chemistry equipment for science class. So goes the pattern for computer equipment. For example, if new technologies are purchased for the computer lab, those teaching computer science are most likely aware of some of its capabilities and uses. It is likely, however, that the other teachers are not considering what this equipment can do for their role in education. If this is the case, that equipment is not being fully utilized in the school. "Even after twenty years of bringing these new technologies into schools and offering training, we are finding that a large percentage of teachers report feeling ill prepared to use them in curriculum rich ways" (McKenzie, 2001, p. 4).

Today's society is engrained in connectedness. The school's isolated systemic nature is not. "What should we do with this equipment? is too often asked after the equipment has been bought" (McKenzie, 1993, p. 20). Teachers are failed when isolated systemic practices are used.

The institutional and systemic natures of the school could be labeled as two of the greatest causes of resistance to effective change. Institutionally, change tends to be slow and hierarchical. As Cuban (2000) noted, initiatives are top down, and often

not led by the people burdening the impact of the change. Systemically, McKenzie (2001) argued that poor communication and planning is not enabling effective change to take place. These authors may be implying that more focus needs to be on the whole of the institution and on the teachers and the students, rather than on the desire to keep in trend with society's pace regarding technological changes.

The Tendency for Adaptation versus Transformation

Education systems and educators have a tendency to adapt to change around them and to incorporate change into the classroom in a variety of ways, but some theorists declare that adaptation or incorporation is not what is needed in the face of technological reform. As Salisbury (1996) wrote, "Adaptation is a process for making modifications to bring the system in line with small changes in its environment…[it] only works if changes in the environment are relatively small" (p. 29). Salisbury argued that changes such as those that the techno-age brings with it require not adaptation, but a complete transformation, a practice which educators are not as apt to doing. Transformation changes are required when "the system has neglected to adapt itself gradually and now faces a major gap between itself and its environment" (p. 29). This transformation requires rethinking and reorganizing, or perhaps an entirely new system more in tune with the modern world.

This discussion precedes the argument regarding whether or not transformation is actually required. Did we learn from Edison's faulty prediction that the motion picture would revolutionize education? Are we undervaluing the effects of the classroom teacher? Hewitt (2000) argued that transformation is not needed,

nor is it desired. Hewitt stated that computer driven lessons that assume some of the teacher's responsibility are less successful than ones that are in synch with pedagogically sound teacher-driven instruction, and that like previous technologies, it is not surprising that computers have not yet, nor are expected to, revolutionize education. Cuban (2000) concurred when he said that teachers must be left with choice.

> Technology can help drive change. Sometimes it's a catalyst. But it is not driving most school reform efforts. And I can imagine a fine school that uses no computer technology at all. We need to be honest and open to debate about value conflicts – not determined that wiring schools and sending teachers to workshops is the only right answer. (p. 3)

This leaves open the idea that perhaps transformation is not the direction for our modern schools in the face of technology, and that more research must be done to arrive at a better answer to this debate.

Control and the Educator

Amidst a lot of criticism about its impact and style, the lecture is still the most preferred method of teaching for educators and those aspiring to be educators today (Bedient, 1995). Bedient commented that despite the lack of student involvement, and the indication that other teaching strategies reach different learners, teachers prefer the lecture the most. Anderson (1995) agreed that there is a problem in this preference when he quoted, "…teachers themselves must model lifelong learning.

They must spend more time working as mentors and coaches than as lecturers and information transmitters" (p. 62).

With the implication that traditional teaching methods are a thing of the past, educators are not only faced with great change, but are also faced with the task of letting go of the comfortable, trusted, timed, predictable lectures that they are so used to. This task of letting go of control may be one of the reasons that the technological change appears to be so daunting.

Can educators give up the element of control? Bedient (1995) claimed that it is necessary, but will "force us to become learners along with our students in ways we have not experienced before" (p. 79). Along with the element of control with the lecture comes the element of "turf" control. A teacher in a classroom has control of the space, the environment, the information, and the timing. The technology shift does not offer this control. "…'Turf-guarding', not a scarcity of dollars, is preventing motivated and otherwise creative educators from making greater strides to blend technology into the culture of their school" (Williams, 1993, p. 2). Consider, as well, the added expectations of collaborating with outside businesses and institutions, and the idea of educator control becomes an impossibility. Usdan (1995) suggested that, "…education will be defined as more than just traditional schooling, [and] definitions of students …will be broadened to include recipients of educational services in a whole range of non-school settings" (p. 13). This appears to be much different than the traditional functioning of schools.

On the flipside is the question of whether or not the issue is one of control at all. Hewitt (2000) argues that the problem lies in the fact that people assume that

classrooms require motivating lessons and exciting delivery. This is not the case. Rather what is important is "ensuring that students (are) engaged and doing something…that fosters deep rather than superficial understanding" (p. 33). This, as argued by Hewitt, cannot occur without the teacher being in control, rather the teacher must be committed to invest more time to organize and monitor these activities.

Homeostatis and the Educator

Homeostatis is described as "a tendency of a system to move back to a previous state of equilibrium after being disturbed by external forces" (Salisbury, 1996, p. 26). This collection of counteracting forces exists anywhere where the human element in an organization is faced with substantial change. Salisbury stated that this phenomenon explains why many initiatives do not progress much further than their pilot sites. How often is it that educators witness great ideas being introduced through professional development, workshops and in-service days, only to be swept under the shuffle of the business of a school day, then week, then month, until the initiative is long forgotten? Salisbury proposed that any kind of major change or initiative in a system must include a plan to overcome multiple counteracting forces that exist that attempt to change the system back to its original state, or the initiative will not be successful. Bandura's (2000) theory of the processes of self-efficacy parallels much of Salisbury's (1996) ideas of homeostatis. Bandura (2000) addressed that low self-efficacy in projects often leads to early

abandonment (p. 22), thus there may be a strong connection between homeostatis and self-efficacy in education.

The Technology Presumption

The technology presumption can be defined as the assumption that, observing the use of technology in business, one must presume that technology is a great and necessary innovator for education. "The technology presumption is largely responsible for five years of school technology spending that put the cart squarely before the horse…but the presumption continues to sway many decision makers" (McKenzie, 2003, p. 2). McKenzie's words point out that for whatever reasons, many educational institutions have invested in technology with the presumption that it is the right answer.

Armstrong and Casement (1998) agree that the money invested in technology has been foolhardy, stating that "vast sums of money are still being spent in our education system on integrating a technology whose effects are unproven and in many respects counter productive" (p. 83).

Paralleling these views, Cuban (2000) warns us that it is an error to make this presumption and that key questions must be addressed before any technology initiatives are implemented. Whatever the case, when schools decide to implement change, educational initiatives must precede the technology, or the presumption that simply having the equipment leads to reform will once again, mistakenly take over.

Valuing the Working Conditions of Educators

When considering technology and the changes that it implies for educational institutions and educators themselves, it is imperative to look at the current conditions in the institutions and in the lives of educators faced with the change.

Geelan (2002) summarized that educators are faced with a number of issues that present challenges to their profession, and that these conditions affect what they are able to accomplish on the job. Challenges include class size and composition, curriculum change, professional development, teaching resources, funding issues, urban/rural inequalities, the physical environment, societal influences, teacher wellness and achievement testing. These issues, although they will not be discussed at length in this review, greatly affect how educators are able to perform their responsibilities. Geelan argues that attention must be paid to these issues so that students' needs can be met. Without attention to these issues, greater initiatives cannot succeed. Sergiovanni (2000) concurred, but phrased this phenomenon as the lifeworld of educators. He stated that:

> The more teachers know and the more skilled they are…the more successful schools will be in advancing learning. Whether teachers will know more and become more skilled depends upon the support they get from policies and contexts…In many places teaching is undervalued, and the conditions for supporting teachers are underdeveloped. This situation has consequences for the lifeworld of teachers and schools. (Sergiovanni, 2000, p. 123)

Sergiovanni (2000) described that the success of educators is dependent on whether or not they are "invested with enough discretion to act, to get the support they need to teach, to become involved in continuous learning, and to be led by effective leaders" (p. 140). Sergiovanni's thoughts cannot be considered independently from change or self-efficacy, since these two factors influence the support that educators might perceive as necessary.

Cuban (1996b) described the variance in technology uses in schools as an "episodic and uneven implementation" (p. 124). He believed that once teachers are provided with sufficient access to technologies, creative training and preparation, and secure, technical help, then teachers would do what is needed in the classroom. He warned, however, that this assumes that "the task of implementing any organizational innovation…is little different from implementing a new reading program, a novel math curriculum, or higher academic standards" (p. 125), and this may not be true for technology innovations, possibly because technology is often used for instructional purposes, while reading programs and math curriculum are considered to be part of the instructional content. It is also possible that the beliefs of the educators in effective teaching and learning practices are very different from that of the administrators and policymakers. Thus, regardless of how passionate administrators are about technology innovation, the initiative will not go far without teacher endorsement.

The conceptual framework that follows outlines the relevance of this literature in framing the research problem for this study.

Conceptual Framework

It is apparent from the literature that there are at least four major areas that have an affect on the ways in which the educator incorporates technology in the classroom. These are: response to change; beliefs of effective educational practices; self-efficacy perceptions; and the conditions in which the educator works. The educator, then, would most likely fall at some point on a continuum between the polar ends of debate in each area, and this would determine what the educator perceives is the most effective use of technology in education.

Again, the objective of this research was to investigate the perceptions of individual educators relative to issues surrounding the incorporation of technology in education, with a focus on the research questions being: the degree that the individual educator's strategies have changed to respond to new technologies; the degree that self-efficacy has played in the use of or lack of use of technology in education; and the educator's perceived ideal incorporation of technology in the classroom. Through these research questions, valuable information and insight will be gained regarding change and the educator, and self-efficacy as related to technology, as well as information regarding perceptions about the ideal use of technology in education from the educator's point of view.

Figure 4 depicts the research problem in a visual manner, indicating that the areas of change, educators' beliefs, self-efficacy and current conditions in schools today affect the educator's current use of technology and his/her perception of the ideal incorporation of technology in education.

This framework contends that an educator's current use of technology is dependent on the four categories identified in the literature review. These are: the personal and institutional response to change; the educator's beliefs of effective educational practices; the educator's personal self-efficacy beliefs; and the current conditions in which the educator works. It is suggested that these four categories play a role in determining not only how the educator currently uses technology in education as represented by the double ended arrow, but also what educators perceive as the most effective incorporation of technology in education.

This framework is the basis for the research. With an increased understanding of selected educators' perceptions in each category, perhaps a greater understanding can be achieved regarding the current use and ideal incorporation of technology in education.

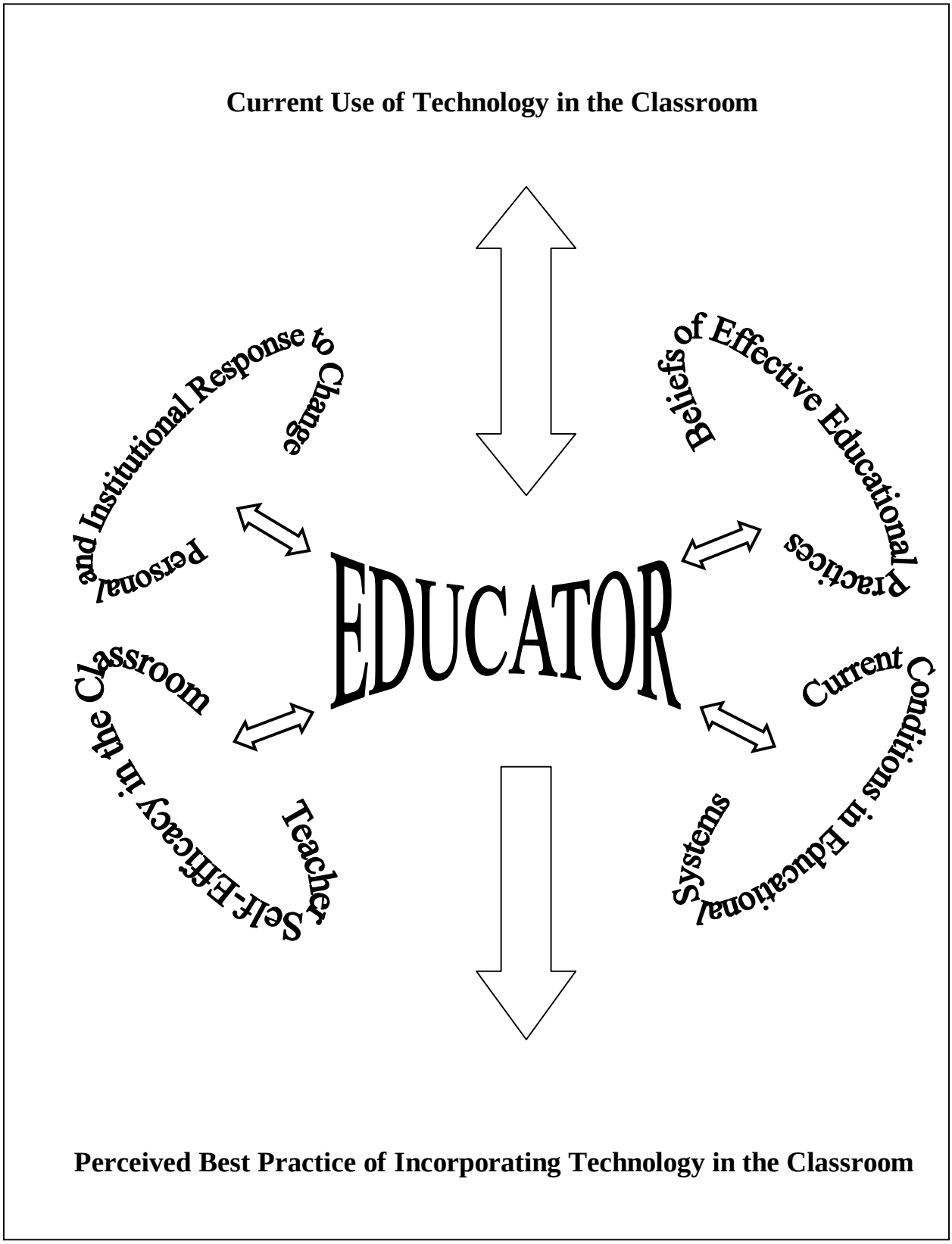


Figure 4 - **Conceptual Framework Diagram**

Summary

This literature review has focused on four major areas that have an impact on technology in education: responses to change; beliefs of educational practices; teacher self-efficacy; and the current conditions in the life of educators. At a minimum, it is these four areas that may combine to determine how an educator incorporates technology in the classroom, and what the most effective use of technology in the classroom is.

An individual's response to change determines how able he/she is to incorporate technology in education, but this ability is also combined with his or her beliefs in what strategies will bring about outcomes consistent with his/her values. Along with this, an educator's beliefs about his/her own abilities to effect change in his/her students' lives will further impact his/her views on technology in education, and these beliefs can only be realized if the conditions of his/her employment allow the changes to prevail.

Chapter 3

Research Design and Methodology

"To learn anything fast and effectively, you have to see it, hear it, and feel it."

- *Tony Stockwell* retrieved from http://www.state.me.us/education/iasa/title1a/quotes.htm

The purpose of this study was to explore educators' perceptions of technology in education, specifically to investigate to what degree the educator's strategies have been informed by technological change, to what degree self-efficacy has played in the educator's use of (or lack of use of) technology in the classroom, and what is the educator's perception of the best practice of incorporating technology in the classroom.

Research Design

This study lent itself to a qualitative method of research in order to determine the attitudes, beliefs, and self-perceptions that educators have that influence the way that they incorporate technology in their teaching. The qualitative and rich nature of the information sought required that a naturalistic method be used. Naturalistic research provided the opportunity to enter the subjects' environments to learn about their concerns, with the setting as a source of data along with the participant so that understandings could be supplemented by being on the premises (Bogdan & Biklen, 2003). According to Bogdan and Biklen (2003)," qualitative researchers are concerned with making sure they capture perspectives accurately…they reflect a concern with capturing the people's own way of interpreting significance…" (p. 7).

Semi-structured interviews were used in this study as that approach lent itself appropriate to a study aimed at presenting educators' perceptions.

Research Methodology

The following section outlines my approach to obtain ethical, useful data for this research, and includes information regarding the participants, the setting and the data analysis methods used for this study.

The Participants

Ten participants for this study were chosen using purposive sampling. The reason for purposive sampling was that I was interested in obtaining potentially rich, useful data from a variety of participants. Since this study would not be generalized over a large population, random sampling was not necessary. Purposive sampling also allowed me to choose, from the network of colleagues with whom I have become familiar with over the past eight years: participants who have a variety of teaching experiences, teaching years, and technology knowledge. This study did not require that only those with a technological background be selected; rather, its framework depended on a variety of participants who could provide potentially rich information regarding the areas outlined in the conceptual framework and research questions. In using purposive sampling, I selected my sample based on my knowledge that the educators that I picked are typical of the population of educators that I was studying, with an understanding that I had no need to generalize my results over a larger population. Purposive sampling also allowed me to handpick individuals who met the needs of this study. For example, I wished to select individuals who are confident with technology, as well as individuals who prefer to avoid using technology in the

classroom. I selected five educators from the elementary schools and five from the high schools. Any educator with a professional certificate who was currently teaching was considered, regardless of his/her position in the school. Participation was voluntary, and was done after school time, following the study application approved by the Advisory Committee on Ethics in Behavioral Science Research (Appendix A). I also used purposive sampling near the end of the interviewing process, when I realized that I had only included one female participant. Because I wanted to get a good mix of applicants, I made sure that the last two participants were female.

The Setting

Most of the interviews for this research were conducted on site at the educators' schools, out of school time at each participant's convenience. Two participants preferred to be interviewed at other locations. The purpose of interviewing most participants on-site was two-fold. First, I wanted to avoid inconveniencing the participants and I also wanted to have them feel comfortable. Second, by being at their school site, I hoped to get a sense of the context in which they teach. According to Bogdan and Biklen (2003), participants should be studied so that "nothing is trivial, that everything has the potential of being a clue that might unlock a more comprehensive understanding of what is being studied" (p. 5). I tried to create the opportunity to see items related to technology in their classrooms or environments that may have triggered questions, giving a more rich and meaningful picture of the lifespaces, attitudes or beliefs of each participant. For example, if an educator was working in a classroom with six computer stations, I was able to structure questions somewhat differently than if there were no computers in the room.

The Interview Method

The chosen interview method proposed for this research was the semi-structured interview consisting of two parts. The first was a spectrum continuum, which I used as an introductory segment to the interview, and the second was a set of questions submitted as overarching questions (Appendix B). These were submitted as overarching questions since they were intended to act as the framework for the question portion of the interviews, but depending on the information collected during the spectrum portion of the interview, as well as the information provided by each participant, I was able to modify the questions as I proceeded through each interview. The spectrum and the overarching questions were chosen because of their adaptability to participants and their responses, as discussed below. One interview of approximately one hour in duration was planned for each of the ten participants, during which both the spectrum and the overarching questions were completed and discussed.

The spectrum continuum. Due to the nature of the information sought, I needed a tool that allowed me to tailor questions according to the information or direction that each participant led me. To use Rubin and Rubin's (1995) term, 'guided conversation', I chose to let the participants' responses be my guide to further questions as the interview progressed. I constructed a spectrum to be used in the first part of the interview to provide direction for each session. This spectrum, included in Appendix B, consisted of four arrow segments on which the participants each indicated where they perceived themselves to be according to the words and images. Prior to its completion, I discussed with each participant what it was that I was asking

them to do, and described the meanings of the diagrams at the ends of each spectrum. I then asked each participant to make a checkmark or notch on each spectrum to indicate where they perceived themselves to be. Following its completion, I was able to use the spectrum to guide me in asking questions such as, "You indicated that you find change to be very difficult for you. Tell me about that," or a question such as, "Please share with me a story about a time that you felt that you made a difference in the classroom." This spectrum also led to further discussion, which provided answers to some of the overarching questions; therefore, I modified those questions as we went through them in the interview to avoid redundancy.

The four elements of the spectrum matched components from the four categories in literature that may have influenced the educator as outlined in the conceptual framework. The first element of the spectrum related to how the individuals perceived that they handled change on a personal level. The second spectrum related to their self-perception of being a traditional educator versus an on-line educator. The third spectrum related to their ideas of self-efficacy, and the fourth spectrum was related to their thoughts on the nature of school institutions in preparing the educator for technology in the classroom. In constructing the spectrum, I made sure to avoid placing graphics that indicated a 'pro' technology slant all on the same side, so that the research leaned neither to technology nor to tradition as the 'right' or the 'left'.

The overarching questions. Following using the spectrum as a point from which to start the interview, the overarching questions, included in Appendix B, provided me with more structure to help me refocus on the research questions when I needed it. I used these questions as a guide, and also asked other questions to attain

valuable data on the spot, depending on where each participant led me. "…By developing and using questions on the spot, a qualitative researcher can gain a more in-depth understanding of the respondent's beliefs, attitudes, or situation" (McRoy, 1994, p. 1).

As mentioned above, some of these questions had already been touched upon during the spectrum portion of the interview; therefore asking them again would have been redundant. I tailored the questions on the spot for each participant to account for this redundancy.

The interviews lasted approximately one hour, and were audio-recorded. I also had them transcribed. I delivered the transcripts to each participant and included any changes that they made on their transcripts.

Also included in Appendix B is a table on which I indicated the relevance of the interview questions to the conceptual framework and research questions.

Observations. Observations were also made during the interviews. Notes were made on the environments in the classroom, specifically the numbers of computers in the room, the age of the machines, and the quality of the computer labs. This information was intended to provide a greater understanding of the environment in which the participant worked.

Trustworthiness. I had the data collected from each tape-recorded interview transcribed. I then sent a copy of the transcript to each participant for member-checking, along with a copy of their completed spectrum. At this point, participants had an opportunity to read their transcriptions, check for accuracy and ensure that the transcriptions reflected what it is that they intended to express. At this point, some of

them added, deleted or altered information as they wished. Following their revisions, they returned the transcripts to me along with a consent form for release of data and transcripts.

Data Analysis

In order to maintain a clear focus for each interview, data were analyzed once all interviews were completed. To initially manage the results, the data were primarily grouped into the main areas outlined in the conceptual framework, being: their current use of technology in education; personal and institutional response to change; beliefs of effective educational practices; teacher self-efficacy in the classroom; current conditions in educational systems; as well as their perception of the best practice of incorporating technology in the classroom. To manage this group of data, I organized the information collected from the transcripts into the four areas using copy and paste functions. I also grouped all data regarding personal information and experience and created a collated chart and summary of this data.

As I intended, I then used open coding to further analyze the data. I scrutinized the data to merge it into groups that seemed to fit the data. I initially coded the data along the ideas of change; time; training; self-efficacy; motivation; frustration; support; and best practice. To manage this group of data, I simply wrote the appropriate code beside the responses on the printed collated data sheets.

Following this initial grouping and coding, I was able to examine the information that I collected as to how it pertained to the research questions. I discovered six themes from this initial coding. They were: 1) the influence (positive and negative) of technology in education; 2) changes that educators have faced because of technology in education; 3) educators' perceived self-efficacy regarding

incorporating technology in education; 4) forces which promote or inhibit the use of technology in education; 5) how technology is being used in the classroom; and 6) the perceived ideal use or benefits of technology in education. To manage this data, I finally created a master transcript and copied and pasted data collected from each interview question and each participant together under question headings, and then grouped this data according to the theme that each question addressed. I then printed and manually managed this data, crossing off answers as they were recorded into the appropriate portion of the chapter, described below.

I then answered each research question using information from the themes that pertained to it. For example, research question number one, which was: 'To what degree has the educator's instructional strategies been informed by technological change?' was answered using four of the theme categories including: 1) the influence of technology in education; 2) the changes that educators have faced because of technology in education; 3) educators' perceived self-efficacy regarding incorporating technology in education; and 4) forces that promote or inhibit the incorporation of technology in education. These four themes were then elaborated upon each in part, and summarized in whole as they related to the first research question. This was repeated using relevant themes for each of the two remaining research questions.

Along with using the spectrum as a device from which interview questions were stemmed, it also served another purpose. Using this device, I was able to recognize patterns and make connections between the perceptions that participants reported on the device with perceptions that they stated during the interview. It was also a helpful tool, which I used to recognize unusual data and explore it further.

Use of an Auditor

Once I had coded and written my preliminary analysis, I asked a university colleague to audit the data for me. That is, I asked this person to read the data and indicate what categories or themes he saw, and how he would interpret this data. This practice was valuable as it led me to look at the data in ways that I had overlooked before. Once the auditor provided me with a list of themes that he felt emerged from the data, I compared them with my own, and most were the same. This affirmed my discoveries. The differences that the auditor observed were in the form of the current conditions in educational institutions. He chose to categorize data into forces that promoted the use of technology and had a separate category for those that inhibited its use. I chose to group this into one theme called forces affecting technology in education.

The Final Product

The final product of this research is this thesis, consisting of the problem, literature review, research design and methodology, data collection, data analysis and results.

I disseminated the results in the narrative form as I described above. I also used the spectrum to create a visual presentation of the data, indicating where the participants perceived themselves to be on each continuum. This provided the opportunity to correlate the interview data with information collected on the spectrum. According to Bogdan and Biklen (2003), using visual devices is increasing in its use, and "can be employed in all stages of analysis from planning to the finished product" (p. 158).

Also presented is a discussion of the findings and possible implications for educators and administrators; however, this is done without the implication that this data can be generalized over larger populations.

These research findings also may be later used in presentations or educational journals as opportunities arise.

Ethical Considerations

Application to conduct this research was made to the University of Saskatchewan Advisory Committee on Ethics in Behavioral Science Research. The following was done to ensure that the participants' involvement was of an ethical nature:

1. Consent was obtained at the administrative level of the participating school board, as well as from the administration of the participating schools;

2. Participants were informed of the nature of the study, the data collection methods, the data analysis techniques, and the dissemination of the information, and were free to not answer certain questions or to withdraw from the study at any time;

3. Consent forms for the interviews, and transcript and data release forms were used; and

4. Every effort was made to ensure the confidentiality and anonymity of the participants, including removing the names of the schools, colleagues, administrators and participants in the study.

By adhering to these ethical considerations, the expectations of the Ethics Committee were met. The letters pertaining to ethics documentation are included in Appendix A.

Summary

This chapter has described the nature of the research that was used, and the specific qualitative tools that were employed in the data collection, using the interviews and the visual spectrum device. The methods by which data were analyzed and compared were also described. Included as well, the process by which I ensured ethical considerations for the participants was presented.

Chapter 4

Data Presentation and Analysis

This chapter presents the data collected from the interviews and the spectrum activity. The results are presented with a summary of the participants and their diverse backgrounds, a summary of the data collected as it pertains to the themes observed, and a summary of the spectrum activity collated by spectrum question.

Interview Participants

In using purposive sampling for this thesis, data were collected from educators in a variety of positions, as indicated in the methodology section. Five of the educators were from high school, and five were from elementary school. Interesting to note is the fact that most participants had little formal technology training, and that all participants indicated that they were self-taught in the area of technology in education. No policy was in place regarding technology use in the classroom.

Three of the participants were administrators – one high school principal, one elementary principal and one elementary vice principal. Both principals did not currently teach in the classroom, but were active in the technology implementations in their schools. The elementary vice-principal taught 75% in the classroom, and taught the computer portion of his students' timetable.

Purposive sampling in this study allowed for the inclusion of supportive educators in the schools, so one elementary learning assistance teacher was included, one high school teacher librarian, and a high school teacher allocated specifically for computer science also participated. Although not all educator roles are represented in this study, a diverse selection has been included.

Participants' years experience ranged from 5 – 31 years with four participants possessing less than ten years experience, and three possessing twenty or more years.

Many educators had enough experience dating back to the 'pre-technology' era of education, thus were able to share information regarding its early implementation initiatives as well as current implementation initiatives.

Most educators had access to a computer for their professional use. The elementary educators were limited to only one to three computers in the classroom and weekly access to the elementary school lab. The high school educators in the social sciences and history had no computers in the classroom, with occasional access to the library computers, while the computer sciences teacher had access to one newer computer per student in a well-fitted lab, and the teacher librarian worked with a one computer per two students ratio.

All elementary educators indicated that they taught in all subject areas, while the high school educators, unless they had previous experience in the elementary schools, taught only in certain subject areas. This may have had an effect on the ways they incorporated technology in their classrooms.

As the interviews were underway, for unintended reasons, out of the first eight participants, only one was female. In an attempt to ensure that data were not biased, the last two female participants sought were intentionally targeted.

Pseudonyms were used for all participants, and letters representing their pseudonyms were used for the spectrum analysis in this chapter.

Table 1 is a summary of the participants, their positions and their experiences.

Table 1 - Summary of Educators' Professional Information

Educator	Years Teaching	Present Position	Grades Taught	Subjects Taught	Technology Training	Letter in Spectrum	Observations in Field
Matt	19	Elementary Vice Principal	1-9	All elementary	1 U of S class 1 Kelsey class several workshops self-taught	M	N/A
Donnie	31	Elementary Principal	5-12	All elementary High school P.E. & Health	Self-taught	D	N/A
Kathy	10	Elementary LAT	K-6 & Special Ed.	All elementary	Inservices self-taught	K	2 computers in LAT room
Oliver	8	Elementary Grade 8 teacher	4-9	Everything except Science	Self-taught	O	2 computers in classroom 27 in lab
Colette	7.5	Elementary grade 1 teacher	K & 1	All elementary	1 inservice husband helped self-taught	C	3 computers in classroom 28 in lab
Bernie	20	High School Principal	Kelsey U of S 9-12	Science Biology, P. Ed., Chemistry Christian Ethics English	1 U of S class self-taught	b	1 newer computer in office
Jane	5.5	High School Social Sciences Teacher	K-12	All elementary High School: Science, History, Christian Ethics, Social Studies, Choir, English	Workshops self-taught	J	1 teacher computer in room
Jeff	5	High School History Teacher	9-12	Social Studies, History, P. Ed. Psychology, Drama, English	1 computer class self-taught	j	1 teacher computer in room
Greg	16	High School Computer Science Teacher	7-12	Industrial Arts, Science, Math, Computer Science, Economics	M. Ed. Classes self-taught	G	32 newer computers in lab (2 labs in total)
Bryce	20	High School Teacher Librarian	3-12	All elementary High School English	2 university classes self-taught	B	16 research computers & library classroom being developed

Interview Data

As indicated, the purpose of this study was to investigate the perceptions of educators regarding the incorporation of technology in education, specifically in the classrooms of both elementary and high schools, with a focus on the three research questions.

Each research question is analyzed below, according to themes discovered from the research. There were six themes discovered: 1) the influence (positive and negative) of technology in education; 2) changes that educators have faced because of technology in education; 3) educators' perceived self-efficacy regarding incorporating technology in education; 4) forces that promote or inhibit the use of technology in education; 5) how technology is being used in the classroom; and 6) the perceived ideal use or benefits of technology in the classroom.

These themes are presented under the headings of each research question, as some themes are common to more than one research question.

Themes Related to Research Question# 1

To what degree has the educator's instructional strategies been informed by technological change? There appeared to be a variance in the degree that the educators' education strategies have been informed by technological change. The variance in this degree of change was influenced by four factors, which emerged as themes. These themes included: 1) the influence of technology in education; 2) the changes that educators have faced because of technology in education; 3) educators' perceived self-efficacy regarding incorporating technology in education; and 4) forces

that promote or inhibit the incorporation of technology in the classroom. These four themes are elaborated upon each in part, and summarized in whole as they relate to the first research question.

The influence of technology in education. From the data collected, it is apparent that these participants realized that technology had greatly influenced their work as educators. This influence has been both positive and negative, and with this influence came reasons that teachers embrace or resist the change. Educators realized the importance of using technology in education. "Technology has changed the language that we use. The terminology is out there, and whether we like it or not, we have to get with what's out there in the real world" (Donnie, p. 3). Educators also realized that it is important to start young, since "you go anywhere, there's a computer; you talk on the phone, it's a computer" (Colette, p. 5), so it is very important that students get accustomed to using technology and get comfortable with technology early.

Educators used technology to access information quickly. "Technology has helped me in finding information and resources – to find new ways or strategies, ideas or information in the classroom" (Jeff, p. 4). This access to information served as another resource for those teachers who used it.

Educators saw the benefits that technological change had on their students. "Technology has allowed more students the opportunities for success…[because] students love using computers. It has been a lot easier to motivate the students to do work in math or in language arts...to help them reach their potential" (Matt, p. 3).

The benefits of this new technology extended to research since “students have the information right at their fingertips” (Jane, p. 3), and it assisted students in creating “more polished and publishable materials” (Bryce, p. 5). Whether it is in the way that teachers accessed information for their students, or in the ways that students used technology, these educators affirmed that it has had a great impact in education.

Berge and Mrozowski (1999) suggested that technology benefits students in the areas of delivering higher student achievement, motivating learning, assisting in special needs education, improving attitudes toward school, and freeing teachers to allow for more one-on-one time with students. Tapscott (2001) argued that computers have taken students away from the TV to doing activities that involve search, reasoning and self-learning. “When they are online they are reading, analyzing, authenticating, contextualizing, sorting the digital wheat from the chaff, composing their thoughts [and] criticizing” (p. 4). The findings in this study do not contradict these authors, rather they complement them.

These educators reported that technology has been noticed in the classroom, but also outside the classroom in the area of administration. Technology had assisted administrators in keeping track of marks, student attendance, and other information, and has assisted teachers and administrators in communicating with one another in more time efficient, convenient and economical ways.

Educators in this study were aware of the benefits that technology contributes to student education, but these educators appeared to be unwilling to hail technology at face value, since they were also aware of the problems that it brings about.

Technology related instruction problems include finding a balance between using books versus using the Internet, especially in research. "I gave [my students] an assignment in social studies where they had to find information in a book. A lot of students did not know how to find the information in the books; they are so used to finding the information on the Internet" (Jane, p. 3). This comment brings to attention that there may be a value in limiting computer access, especially if the students have a dependence on the search engines versus researching using books.

Along with this idea is the possibility that "teachers don't have the kind of tools to teach students how to research on the Internet and how to use technology effectively" (Kathy, p. 4). Echoing Kathy's views was Oliver's point that "it's great in researching, but the problem with the Internet is you don't know where the information is coming from like you do with a book – anyone can put anything on the Internet" (p. 4). This implies that technology is a good tool in education, but time must be spent to ensure that students understand the basics of research, the value in knowing the sources of on-line information, and the value in not relying on the Internet for all of their information.

Many educators also shared the idea that sometimes students submit material that contains plagiarism, therefore, it is important to teach students how to do Internet based research, and to devote time to checking up on sources and discouraging the practice of copying and pasting.

Another valuable point that deserved emphasis is that some students do not have the economic privileges of having a computer at home. Oliver noted that computer use at school "makes it harder for some kids if they don't have a computer

at home, or if they have to use one at school and share with other kids…the students can experience stress because they have to learn something new and they can't do it at home" (p. 4). Oliver may have implied that technology has its benefits, but the impact of this technological change may reach into other areas than educators initially realize, such as financial pressure on families or stress on students.

From this information, undoubtedly it is obvious that technology has influenced education over the past number of years, both in the classroom and for administrative purposes. This impact, however, is both positive and negative, and it depends on the educator, the student, the subject, and the environment in which they learn. As Hewitt (2000) emphasized, teachers must spend the time ensuring that technology is incorporated into lessons that are suitable for it and in which the students are engaged. From the data derived from this question, it is apparent that each educator has been given the challenge to weigh the benefits and drawbacks of technology use, and determine the most appropriate use of technology in education for specific learning situations.

Changes facing educators. The second theme that emerged from the first research question was related to changes that educators faced because of technology in education.

Educators have faced change because of technology in information acquisition, in instructional methods, in curriculum to a limited extent, and in the way that students use technology for learning and presenting their work. The changes

varied in impact according to the position of the educator, as well as their perception of the benefits of accepting and embracing technology in education.

The administrators in this study focused on the manner that they progressed with technology implementation in their schools. Bernie, the administrator in a large high school, emphasized that any technology initiative in their school required careful planning. "We must develop a very structured implementation plan" (Bernie, p. 6). Bernie realized that teachers may be uncomfortable with change, therefore, great emphasis on strong implementation may be key in paving the way for effective technology use in his school. Donnie, also an administrator, repeated Bernie's thoughts when he stated that "change is difficult and…it's a push to have staff get used to and use the technology" (p. 6). As stated by Salisbury (1996), in an organization, no action is unilateral in its impact, and effective implementation requires that one looks at all parts within the organization. Both administrators appeared to parallel Salisbury's theory, and relayed the idea that administrators have a great impact on the level of technology integration that occurs in their schools, and to effect change means to ensure effective, meaningful implementation.

Some educators in the positions of classroom teachers reported little change in their teaching strategies, while others reported larger changes. Jeff and Jane, high school teachers in history and English, described the fact that their subject materials limited what they could do in class with technology. "I use technology for my preparations at home" (Jeff, p. 6), but he went on to share that it was impractical to use technology in class, by stating that, "It would be good if in each classroom there were some computers to be shared" but this was not the case in his high school (p. 4).

In a similar situation, Jane stated that she gave her students web sites, but they had to be researched at home since it was impractical to do so at school because of lack of equipment (p. 6).

Most elementary teachers reported a slightly different scenario regarding the changes that they had made to their teaching strategies since they were with the same group of students every day. These educators could book the computer lab to provide all students with a one-machine-per-student ratio for hands-on practice. Matt enthusiastically shared an interesting example of great teaching using technology in a science class:

> Sometimes I would bring them [into the lab] and have them do a study on earthquakes involving s-waves and p-waves and things like that on-line…I tried to use Slinkies in the past to show s-waves and p-waves and that was fine, but with the animation [on a computer website] it brought the point across clearly to the kids…Things that are visual are extremely important when it comes to bringing across a concept or tackling a new idea. For them to actually see that, actually made a difference. (Matt, p. 5)

Matt's example is a reiteration of an educator in Reid's (2002) study, who stated that it is meaningless for a teacher to draw a galaxy on the board with a stick of chalk, when the Internet is available to give us a view of the Milky Way from a space telescope. Following this example, however, Matt shared that he was limited as to how much his strategies had changed, based on how often he could actually book the lab. He said that having infrequent access to the lab was an issue, and this limited his

opportunity to use technology in education more frequently. Matt reported that he also did his research on the web on his own time, at night, since the computer in his classroom was an old one that did not provide many opportunities for learning beyond old, rote programs (p. 5). Matt indicated that he might be prepared to change his teaching strategies in response to technology in education, but because of limited access to computers and the quality of the machines, he felt limited as to what he could do in the classroom.

Matt's contribution to this question was interesting, especially since he expressed a relatively low confidence level in regard to using technology in the classroom, yet with this example of the p-waves, he appeared to be using technology in ways that Hewitt (2000) predicted would be the most effective. That is, using technology in ways that require careful thought, planning and for "pedagogically sound teacher-organized activities" (p. 36).

Paralleling the just-in-time model of technology use in education as introduced by Auer (2001), one important response that came up often was that the educator had to see a need for incorporating the technology in the classroom or into his/her teaching strategies. Without seeing a need, it was found that these educators deemed it impractical to change strategies that already worked. Comments included:

"You change with what the needs are-where the staff is" (Donnie, p. 6);

"What I use in class now works well for me" (Jeff, p. 6);

> "I don't think I've changed my strategies too much, but the reason I did get involved with it was that I could see there was a need to instead of doing [work] with paper and pencil" (Greg, p. 7);
>
> "…my process is still to first check the encyclopedias and then go on-line to check data bases" (Bryce, p. 7).

Colette, a primary grade teacher, saw a need for using technology in her classroom for a student who had problems speaking. She identified the student and planned for a solution using technology. "She did a lot of language arts things on the computer because it spoke for her…it's another tool" (p. 5). This, to Colette, was a great solution for one student.

What educators were saying was that they would not put the cart before the horse and use technology just because there appears to be a pressure to use it. These educators primarily know the material that they were teaching and the needs of their students. Although there may be an outside pressure to incorporate more technology in the classroom, these educators still would not just jump at every opportunity to incorporate it into the curriculum. These educators had to see a need for it, and then they would work to implement it as best as their environment allowed them to.

In summary, the participants in this study have faced great changes in the incorporation of technology in education, from the ways that they acquire information and the ways that they instruct to the ways that they have students research or present their material. These educators must, however, see a need and an opportunity for success before they abandon their old, successful teaching methods for new ones involving technology.

Educators' perceived self-efficacy. The third theme that was observed from the first research question is educators' perceived level of self-efficacy regarding incorporating technology in education.

The educators interviewed in this study relayed a message that the skills they possessed for incorporating technology in education depended on their perception of the need to learn about technology in order to do their jobs, the time that they had to learn those skills (usually self-taught), and the interest in or purpose for learning the skills. "My skills usually fall into word processing, presentations, laptops and projectors, PowerPoint, and downloading information…all self-taught. That's what I found with most of the experts with technology in the teaching field – self-taught" (Bernie, p. 7). Matt agreed with Bernie, and added that it is a long process to learn what there is to know, but he was tackling it (p. 8).

Once again, seeing a need for and practical use of incorporating technology in education was paramount to considering investing the time to learn about it. Donnie stated that learning technology skills is a personal interest and a matter of saying, "I need to do this. I see an advantage as to how the students will benefit from it" (p. 8). Jane, however, considered herself not very skilled in technology, but capable for what she saw as a need in her classroom (p. 8). Jeff echoed this when he stated that he did not use information that he learned from a technology class because "it wasn't practical. I did not feel that I could use a lot of the ideas given" (p. 8). Bryce also shared a similar idea when he said that, "it's really on a need basis; individuals learn when they need to learn or see a value. People move along when they see a need" (p. 9).

It may be said that the perception of need must precede any implementation efforts for educators to buy into technology and that when educators see a need, they engage in learning how to fill that need. Donnie, however, shared that leaders can manipulate educators into perceiving a need to learn about technology by the way they influence the school environment. Donnie said that when an administration has mandated something such as requiring that each teacher must complete attendance on the computer, or that each student must complete one WebQuest per year, they have manipulated teachers into perceiving a more urgent need to learn about technology or how to operate technology. Positive spin offs can then be expected in terms of how comfortable educators might become with technology and that there may be a tendency for them to use it more in their teaching (p. 6).

From these answers, it is apparent that each educator had very different levels of self-efficacy regarding the incorporation of technology in education, but that each felt he/she was competent with technology in the ways he/she was using it in the classroom. It can be learned, then, that it is difficult to assess self-efficacy regarding technology in the classroom because of the different perceptions of the need for technology in the classroom. To explain, educators interviewed generally stated that they felt competent with technology in the ways they were currently using it, but they were currently using technology according to the need they perceived technology should be incorporated into education. In the future, when they perceive a need to learn more about technology, they will engage in doing so, to the level they would be comfortable to use it in instruction. It was also difficult to separate self-efficacy from the use of technology in education because of the forces that inhibit the incorporation

of technology in education, thus the final theme for research question #1 is included as follows.

Forces affecting technology in education. The last theme includes the support and limitations that educators perceive exist in incorporating technology in education, whether these forces come from the board or administration, the educator's position in the school, or from the educators themselves. Sergiovanni (2000) described that the success of educators is dependent on whether or not they are "invested with enough discretion to act, get the support they need to teach, are involved in continuous learning, and are led by effective leaders" (p. 140). Support, obviously, is an integral part of the success of any initiative and whether or not educators perceive this support exists may have an effect on the degree that the educator's strategies have been informed by technological change. Through various interview questions, educators shared the strengths and weaknesses of this support, but also what they would like to see for support for their initiatives, and this data is also included in this category.

This group of educators shared that there was support in terms of financial assistance through a rotating technology allotment, which came every four years for the purposes of upgrading the computer labs. Once the new computers are purchased for the labs, the old computers go to the classrooms. Support also comes in the form of computer technicians who circulate and are available to troubleshoot and fix hardware and software problems in the labs. They are not educators, but are skilled

in the areas of technology installation and maintenance. Other comments indicating support that were made included:

> "The board shows us support through giving us workshops on the use of technology and money for some programs" (Jane, p. 18);
>
> "People have autonomy over their own projects and they can teach others how to use it – like cyber school initiatives" (Kathy, p. 18);
>
> "The guys that come to fix the computers are very friendly and helpful" (Oliver, p. 18);
>
> "The gentleman at the board office – I've had very good luck with him. He's always returned my calls and [given] me information I needed very quickly" (Colette, p. 18).

This group of participants demonstrated an understanding of the supports and limitations that existed in using technology in education. The educators in this study realized that money is a limiting factor, and overall had a positive perception about the technology support provided to them.

Although this group of educators was pleased with the financial support and the computer technicians, they also realized that the board "is constrained by dollars and cents, so that they cannot supply all the labs that might be required to do the job [of teaching with technology], and that ideally, there should be more teachers and smaller numbers in the classroom" (Matt, p. 17).

There were, however, concerns that were raised regarding the support from administration at the board level in terms of planning for technology success. Donnie stated that, "The [board] needs to develop a plan to educate the people in the schools,

and they need to develop a plan when they transfer staff. They need to find people who they can support to be a leader in technology in the schools. That's where our system falls down" (p. 17).

Greg stated that he did not know if the board understood what was going on with technology in the schools. "I don't think that [the board's] mandate right now is to make any difference with technology" (p. 18). Because of this perceived lack of understanding from administration beyond the school, local school administration is taking the upper hand in some cases to support technology initiatives in the schools. Greg added that the success of the technology changes in his school has been in part from the "very supportive local administration. Very open to change and very encouraging to make changes and try different things and not be afraid of risk" (p. 18). Donnie further added that "the role of the administrator has a great deal to do with the success of computer use in the school – as a facilitator – meaning that [the administrator] has to find out what is being ignored and find the boundaries, money, etc." (p. 17). He did state that although the board had limited funds to assist the school with technology initiatives, they did offer the school autonomy and direction in raising its own funds.

The responses that the educators gave indicate that they still expect initiatives to be led from the top down, as suggested by Cuban (2000), thus decision making that affects the ability for technology to be incorporated in schools may still predominantly be done by people farther removed from where the technology is being incorporated.

Another force that promoted or inhibited effective technology incorporation in education was the educator's time on the job. Participants noted that they realized a need to become more familiar with technology, and to incorporate technology in education, but they had very little time at school to invest in this, and that learning and mastering skills had to be done on their own time. Oliver said that he knew that using a computer makes an educator more comfortable with technology, but that "I need a computer at home to play with; having one in the classroom is not the same. You're too busy in the classroom to play with it" (p. 9). Donnie also shared this view when he noticed that, "the frustrating part is time. You need a block of time when you're uninterrupted, and that doesn't happen at school. At home, I can get the time, but if I don't have the program, it's a problem" (p. 8). This indicates that most educators interviewed have acquired their technological skills on their own, with some limited time for training on the job, but mostly done at home.

Lastly, as discussed with the previous theme, educators' perceptions of technology played a large role in whether or not they incorporated technology in education. These perceptions may act as a driving force for some educators to use or not use technology in education. Oliver made a meaningful statement regarding his perceptions about technology in education when he said that, "The computer can't replace a teacher. A teacher's job is to motivate, guide and inspire self-esteem in the students" (p. 20). Oliver shared that his learning about technology related to his perception of a need for it, and that he felt that students need the relationship more than the computers. Bryce shared a similar point when he said that, "one-to-one contact in the classroom is more beneficial to an individual than the latest and greatest

computer program or the presentation method" (p. 21). This perception indicates that there may be a greater value in educators continuing to establish relationships with the students, rather than sit in front of a computer screen trying to learn the latest in technology, such as in on-line learning, where the teacher is not present.

In summary, the forces that promote or inhibit the use of technology in education include conditions in educational institutions, such as money, planning and the needs of the board, but other forces come into play for the educator, such as time on the job for learning, as well as the educator's perceived need for incorporating technology into education. From the data, it can be summarized that these forces may influence the educator to use technology wherever he/she sees fit, or to perceive that the benefits outweigh the negative forces, or the negative forces outweigh the perceived benefits. The outcome of the effect of the forces depends on the perceptions of the educator who is facing them.

Summary of themes related to research question #1. To what degree have the educator's strategies been informed by technological change? The four themes that emerged from this research question included the influence of technology in education, the changes that educators have faced because of technology in education, educators' perceived self-efficacy regarding incorporating technology in the classroom, and forces that promote or inhibit the incorporation of technology in the classroom.

Much literature in this area contains criticisms for educators for the apparent lack of ability to keep up with the level of technology in society (Hodas, 1993;

Keenan, 2000; McKenzie, 1993). The educators in this study have confirmed those findings, but not for lack of ability to incorporate technology in education, rather it has been for lack of reason. Rather than incorporate technology for technology's sake, these educators appear to have acted in ways that Hewitt (2000) condoned. They seem to have incorporated technology where it was deemed to be beneficial, rather then just because it was available. This was both for efficiency and reliability. It was efficient for them to use what they have already created, since it worked well for them in the past.

The educators in this study realized that technological change had an impact on how education should be planned and delivered, and were influenced by this. Educators could see the potential benefits of technology in education, such as becoming aware of the language that technology brings into society, providing access to information for teachers and students, being a motivational tool for students, acting as a communication tool for teachers, serving as an administration tool, and a tool to provide different ways for the students to learn and to present their learnings, to name a few. It does, however, present problems. The fact that not all students are the same in terms of skills, needs and economic conditions are obstacles to effectively instruct using computer technology. The massive amount of poor information available on the Internet that is easily accessible to students is also an obstacle. Finally, the dependence that some students develop on computers for spelling and grammar checking, or research using search engines rather than understanding how to research using books further complicates teaching, and the question is left to the teachers to answer regarding how much technology to incorporate in the classroom.

What is valuable, then, as indicated by these educators, is the underemphasized fact that the educators' personal contact and knowledge of the students gives him the best ability to assess what those students need and how they can attain it.

Educators' strategies have been informed by technological change, but to varying degrees. Although it appears that each educator is using technology differently, at different times, and for different purposes, educators, where it is available, have provided students with hands-on access to computer technology in meaningful ways. These educators have, however, relayed the message that if technology is not meaningful or beneficial, it has not been incorporated.

Being involved with the students on a daily basis, however, educators also felt the forces in education that promote or inhibit their use of technology in education. Technology has benefits, and the school board and administration have supported technological learning through funding and other supports, but there are also factors in education that inhibit its use, such as economic differences in students, curriculum requirements, time available to train on the job, and educators' perceptions of the benefits of technology in education. Because of these forces, educators have been cautious, and apparently wise not to jump on the technology bandwagon. These educators were aware that meaningful instruction does not always occur in front of a computer screen, but that the importance of books, pencils and personal interactions cannot be minimized.

The reality of the situation of technology in education further comes alive when educators presented their stories of how they have acquired their skills to better

teach students. These skills were wisely attained on a need-to-know basis, usually done on their own time, and usually tailored to fit the needs of their students. Once again, the importance of understanding who they are teaching, and committing themselves to their vocation stands out.

Themes Related to Research Question #2

To what degree has self-efficacy played in the educator's use of or lack of use of technology in the classroom? The themes that emerged from this research question were: 1) educators' perceived self-efficacy regarding incorporating technology in the classroom; and 2) the forces that promote or inhibit the use of technology in the classroom.

Educators' perceived self-efficacy. The first theme that emerged from this question was the educator's perceived self-efficacy regarding incorporating technology in the classroom. "Perceived self-efficacy refers to the beliefs in one's capabilities to organize and execute the courses of action required to produce given levels of attainment. Unless people believe they can produce desired effects by their actions, they have little incentive to act" (Bandura, 2000, p. 18). In interpreting this definition for this study, self-efficacy could mean that unless an educator believes that he/she can use technology in a way that is meaningful or useful in education, he/she will not be inclined to use it. This self-efficacy is present in technology where there is no policy in place requiring that technology be used or mandating how it should be used.

Candidates interviewed had varying perceptions of self-efficacy in terms of their personal knowledge of technology, as partially discussed in the first research question. They did, however, generally feel comfortable to use it in their teachings that they were currently being called to do, with the possible exception of the two middle years teachers.

Colette, a primary grade teacher, was very comfortable with what she was teaching in technology, and believed that her students learned from it. Colette's success with technology in her classroom mirrored what Bandura (2000) stated regarding the motivational and emotional processes of self-efficacy. Colette used technology in ways that benefit her students, and she has experienced success, thus she might be motivated to use the technology since she expects it to produce desirable outcomes.

Opposite in perceptions is Matt, a grade eight elementary school teacher, who reported that he was not as comfortable as he wished he was regarding technology. He stated that he just does not have enough background in the subject to feel comfortable at the outset and has to work hard to really understand the technology before he teaches it. "I will tackle it, but when I do something, I like to know a lot about it. I don't just want to be one step ahead of the students" (p. 9). He added that if he was in the lab with someone who was great at troubleshooting and he could get immediate help, he would have no reservations, but as it was, "I like to be familiar with the program so that I can anticipate [problems] down the road" (p. 10). It is visible that Matt, in relation to Bandura's (2000) work, expected little return from committing himself to technology, thus he may be less inclined to do so than Colette.

Oliver, also a grade 8 teacher, had a similar opinion. His level of self-efficacy in terms of technology is that he was comfortable using computers for his own use, but with students, he was not that comfortable. "I don't know that I'd be doing them the best service…I feel comfortable with having students look up a website, but not with software teaching such as PowerPoint and math programs. I can experiment on my own, but that's different than designing a whole unit to teach kids" (p. 11). Oliver might have chosen to act according to Bandura's (2000) selection process in his theory of self-efficacy. "…people who have a low sense of self-efficacy shy away from tasks that they perceive…or predict failure" (p. 22). Although very talented as a middle years teacher, Oliver felt that he would not be doing his students the best service by taking on the role as their technology teacher, so he chose an environment where he was not involved in that teaching. He opted to let someone else be primarily responsible for technology instruction to his students.

Bryce, a high school teacher librarian, was very comfortable with the technology they have at the school. He was particularly confident with the library databases, and added links to the library web page on a regular basis. Greg, a high school technology teacher with a strong computer lab, was also very confident. "I am always making changes regularly to make sure I'm keeping up to date and finding the most simple way" (p. 11). These two participants appeared to be very comfortable with change. "Change agentry causes them to develop better strategies for accomplishing their moral goals" (Fullan, 1993, p. 2). Bryce and Greg have been consistently involved in improving their technology use because they felt they were capable to better the learning environments for their students in those ways.

In studying the responses from this group, Figure 5 was drawn, a primitive model comparing self-efficacy with the grades taught and the specialization of the teacher.

Self-Efficacy and Technology Model

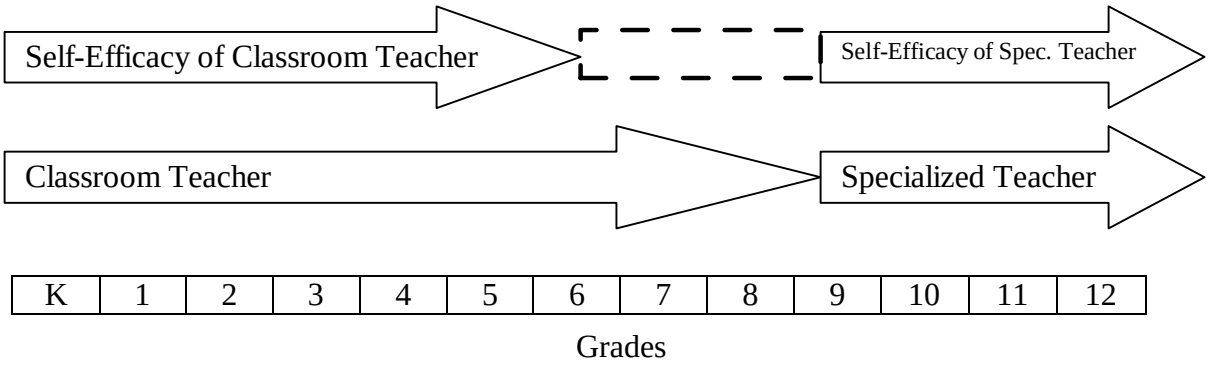


Figure 5 - Self-Efficacy and Technology

This model indicates that in considering technology, the classroom teacher teaches most subjects at his/her assigned grade. In high school, teachers are assigned a specific subject area, thus are designated as a specialized teacher in that subject area. There are specific teachers for computer science. This is indicated by the arrows labeled 'specialized teacher' and 'classroom teacher'. The self-efficacy of these educators is indicated by the arrows at the top of the model. From the interviews, it was observed that self-efficacy was high for the high school computer teacher and teacher librarian, who were assigned to teach technology to the students. In elementary, however, the primary educators had high levels of self-efficacy regarding technology instruction, but the middle years educators indicated that they did not feel competent in teaching technology to their students. This arrow is

indicated on the model, and it ends at mid grade 6 level, showing that the self-efficacy of these educators regarding technology ended before the grade 8 level. The dotted portion of the arrow indicates a possible area where the educators, in this study, assigned to teach technology to those grades did not feel self-efficacy in doing so.

When asked directly about self-efficacy without regard to technology in education, and how the educators felt that they made a difference in the school, a variety of responses were collected, including:

> "It's a personal thing. The connection" (Matt, p. 15);
>
> "Through a strong rapport with the students…they know that I am being fair with them and what I ask for is fair" (Jeff, p.15);
>
> "High expectations, building self-esteem and letting kids know that they are expected to do…their best" (Oliver, p. 15);
>
> "It makes a difference having a smiling face when you come in; being positive is very rewarding" (Colette, p. 15).

These comments indicate that there may be a high level of self-efficacy in the classroom among this group of educators. Without considering technology alone, it can be inferred that making a difference in education is in the delivery of the instruction as a whole, rather than pieced into specific subject areas.

Bernie, an administrator, commented that his making a difference was in finding the resources that his staff required with their projects or programs, and Bryce, the teacher librarian, echoed this point and added that he made a difference by collaborating with other staff and finding resources for them. Bernie appeared to be

acting according to Sergiovanni's (2000) thoughts on self-efficacy and the organization. Bernie chose to spend his time as an administrator, making sure that he is supporting his staff and that there is a collegial culture among the endeavors of technology in education. Bernie chose to adopt a collaborative culture where his staff was allowed the opportunity to become experts and to lead his staff in technology education.

The experience of the educator makes some difference in terms of self-efficacy, but again, not consistently. Matt, who has relatively more experience than Colette, felt that he was not strong at teaching with technology, yet he had wonderful success stories to share about technology use in his classroom. Colette, who had relatively little technology experience, felt that she knew enough to really help her students. There are too many variables with positions in the school, experience and personal needs of the educator to make assumptions at this point, thus this discussion is reserved for the next chapter.

From this information the differences in self-efficacy may lie in the way that educators perceive themselves when delivering technology-integrated instruction. Some have a sense that they have to know a lot, and others have the idea that all individuals in the room will learn technology together. In studying Bandura's theory on self-efficacy, the picture of these educators becomes clearer, and an understanding of the processes under which they are functioning is possible.

Perhaps these perceptions of self-efficacy among these educators vary because of the different perceptions in the purpose of teaching with technology. Some believed that the software must be taught, while others believed that the skills alone

for research must be taught and that the software component would fall into place on its own (Bernie, p. 10). This may be because a common vision regarding technology use in schools is missing. Perhaps this common vision is not possible to attain. Further discussion of this vision is included in the discussion of the third research question.

From this study, however, it is evident that regardless of the perceptions, self-efficacy does play a part in varying degrees in the plans to effectively integrate technology into education.

Forces affecting technology in education. The second theme observed from research question 2 is forces that promote or inhibit the use of technology in the classroom. As discussed in the elaboration of the data from research question #1, there were many forces that promote the use of technology in the classroom, including money to purchase technology, planning, and administration. There are also many forces that inhibit its use, including differences among students, material on-line, educators' time to prepare and learn about technology, and the perceptions of educators regarding the best ways to instruct their students.

Research question #2, however, uncovered the fact that success stories and frustrations about technology in education influenced self-efficacy of technology in education. Success stories may have led educators to believe that they could make a difference regarding technology in education, while frustration stories may have eroded this feeling of self-efficacy. This is parallel to Bandura's (2000) work on the motivational processes of self-efficacy.

The group of educators interviewed shared interesting stories about what excited them regarding technology in education. The responses fell into three categories: Realizing practical uses and good resources available to staff and students; realizing that staff were beginning to accept the change; and seeing motivated students at work using technology.

Bernie shared thoughts on the practical uses of technology, such as using a PowerPoint slide show at a pep rally. He said that it really got things going, and it could not have been done without the new AV cart. "I also like seeing when teachers reduce the amount of time that they spend on things, like the yearbook" (p. 13). Jeff also was motivated by a resource that he found for a psychology class that he was teaching. "I get motivated about technology in education in the psychology 20. More ideas and choices are provided there in the program and in the curriculum. The book format is the same as on the computer, but the computer program offers links to other sites" (p. 13).

Self-efficacy may also come in the form of being able to effect change. The elementary administrator in this study shared an interesting story about effecting change:

> It's exciting when you see the teacher who said 'leave me alone, I don't want anything to do with technology', and then we put a computer in her room. Today, she has her own computer at home, she's on the Internet and she uses e-mail. She really didn't think she could learn. That's the exciting part. (Donnie, p. 13)

Finally, self-efficacy may also come form being able to motivate students, and technology may add to the educator's sense of self-efficacy, as Jane stated, "the kids were really excited when the students did a social studies assignment using research skills, all on computer. They were very excited" (p. 13).

During this study, this researcher noticed that the excitement that students display bubbled out into the enthusiasm of the teacher! Colette shared this story:

> That KidPix program is an awesome program. I used it this year in grade one, but I've used it in grades four and five. It helps students put stories together with pictures and stats. It just brings it more to real life and the excitement they feel in developing a book is awesome! (Colette, p. 14)

Technology appears to be a valuable tool for resources, initiating change, and motivating teachers and staff, but when asked to share frustrations related to technology in education, it appears that there is also a downside.

Educators interviewed shared opinions about computer frustrations. This information is discussed here, because frustrations with technology can be related to self-efficacy since they inhibit the success of the lessons, and as Bandura (2000) stated, the emotional processes of self-efficacy come into play when people experience stress in taxing situations. Although the topics causing this stress vary greatly, from difficulty with supervision in the lab, lack of knowledge about technology, and issues with plagiarism, the largest of the frustrating factors is the technology not working when it is being relied upon. Down time and computer

problems topped almost every participants' list, and there appeared to be no quick fix solutions to this. Here is a summary of some of the responses:

> "Computers freezing up when you are working on something. Frustrating. And not knowing what to do" (Matt, p. 14);
>
> "…frustrated due to my lack of knowledge from the teacher perspective. Also because some students use computers to plagiarize. There are, though, websites available to detect plagiarism. That helps" (Jeff, p. 14); and
>
> "The computer lab is great, but…when you're given half an hour of computer time and it takes you ten minutes to fix things…" (Colette, p. 15).

Finally, this comment by Greg, a high school computer science teacher, points out that some frustration extends beyond computer crashes in class. "I'm frustrated right now, in this point in my career. In trying to instill change and seeing that technology is used to the benefit of the student and used appropriately at a professional level" (p. 15). Greg appeared to be an expert in the technology field. His comment may indicate that, when facing a staff that opposes change, for various reasons, this expert was unable to effect the change and became discouraged and abandoned the mission. This is similar to what Setzer and Monke (2001) noticed about people and change, when they stated that "facing an inherent impossibility of understanding how [computers] work the human response has been not greater curiosity but apathy" (Setzer & Monke, 2001, p. 143).

From these responses, it can be noticed that success stories and frustrations differ according to the position of the educator in the school, the needs of the educator, and the educator's experience. For an elementary teacher leading a group of students, crashes are a dominating frustration point, but for a high school computer expert, issues evolve into trying to effect change in educators who are struggling with their own perceptions regarding technology in education.

Self-efficacy, as presented with the previous question, was a large part of the educators' role. Although they may not have been aware of it, it is possible that it is in part a driving force for all of the efforts that these educators applied to their jobs. "Positive parental feedback. That recharges your battery as an educator" (Matt, p. 16). The opposite, however, may also be true since, as Bandura (2000) stated, those who predict difficulty or failure with an initiative will often abandon it early or avoid it altogether. Donnie clearly personified these frustrations when he admitted, "if you know that you have to teach something and you think your kids know more about it than you do, you'll avoid it using everything rather than teach it" (p. 8).

Summary of themes related to research question #2. The second research question, to what degree has self-efficacy played in the educator's use of or lack of use of technology in the classroom cannot be answered directly for it includes many factors. These include: the level of self-efficacy that each educator perceives they need to teach technology; the experience of the educator; and the forces that promote or inhibit the use of technology in education, including money, planning time, and preferred instructional methods of the educator.

Bandura's (2000) work on the processes of self-efficacy comes to life in the testimonials of these participants. From the information collected, it was apparent that some educators felt that they could do little in terms of valuable instruction in the area of technology, while others had confidence possibly because of their experience, their positions in the school, or the grades or subjects that they taught. It may be, however, that self-efficacy cannot be separated as clearly between subject areas, among the roles of the educators in the schools, or in the different levels of experience that each educator has.

Educators were motivated when they saw that their students were motivated. Educators also got motivated when they saw that what they were doing actually made a difference. Technology sometimes served as an asset to this motivation, but it also served as an obstacle, depending on the forces that influenced its use. The question of self-efficacy regarding technology in education is answered only on a case by case basis, since the forces that motivate or frustrate educators may vary from school to school and classroom to classroom. What was apparent, however, is that educators felt that they made a difference in their students' lives, regardless of whether or not technology was in use. They were able to effect positive change on their students, and were aware of this, thus made a difference – a positive difference.

Themes Related to Research question #3

What is the educator's perception of the best practice of incorporating technology in the classroom? There were two themes that emerged from this research

question: 1) how technology is currently being used in the classroom; and 2) the perceived best use or benefits of technology in the classroom.

How technology is used in education. The first theme, how technology is currently being used in education, revealed the realities of its use in our schools today. This is relevant to the perceived best practice of incorporating technology in the classroom since it serves as a base with which to compare the ideal best practice, and to assess whether or not this ideal is even possible or practical.

To begin, a look into some of the ways that educators are using technology in their classrooms is included. Matt described the way he used technology as providing opportunities for success, as a motivator, and another tool to help students reach their potential (p. 3). Matt's use of technology in this manner revealed part of his picture of 'best practice' – to use what is working well and plan to continue using it. Jane agreed when she was discussing a project that she planned for her students, saying that "[technology] makes learning a lot more exciting and interesting" (p. 3). Similar views were shared by Colette, Bryce and Oliver (p. 3-4).

Other ways that technology is currently being used is in research, as Bryce recalled, "I teach research skills…through emphasis on how to use the Internet effectively…But my process is still to go to the books first so they get the background information, and then they go on-line to check the data bases" (p. 7).

Some educators appreciated the computer for its ability to motivate students struggling to learn in the classroom. Donnie added, "rewriting for special needs kids

[on the computer]…excites them. They're learning to edit, expand, develop language and create a valuable product" (p. 16).

From these answers, technology has been used in education as a way to access resources, present information, learn typing skills, and research, as well as to motivate students, and provide an alternative to traditional learning methods.

Technology and the best practice. Participants were also asked to share their perceptions of the best practice of incorporating technology in the classroom. This question was asked directly to the participants in order to collect direct data that could later be compared to answers in previous questions. Some responses to this question are included as spoken:

> "…have daily access to computers so that it can cover a variety of subjects" (Matt, p.19);
>
> "Multiple computers in the classrooms. One per two or three students…but you still need to do written work and the basics. You don't need the computer all of the time… Half the time maybe, if you had it" (Bernie, p. 19);
>
> "Having at least four computers in the classroom along with a computer for the teacher, and being able to teach students in group situations" (Kathy, p. 20);
>
> Three to five computers in the room, with flow. Have them accessible all the time. They should be part of the teaching environment" (Greg, p. 20);

> "Having 10 computers for 20 students…and have the computers up to date and have educational programs on them" (Colette, p. 20);
>
> "A computer per student per desk, and for me to be able to use PowerPoint, especially in history" (Jeff, p. 20); and
>
> "Ideally, a computer at every desk. I'd put some lessons on the computer. I would still use paper and pencil stuff…but I'd get out of the lab where things aren't working" (Oliver, p. 20).

These comments on the perception of a 'best practice' are varied, but this may be a reflection of the systemic nature of schools, as suggested by McKenzie (1993). In his work on technology in schools, McKenzie suggested that schools may lack the big picture of how technology should be used, and that decisions are far too often made at department levels, possibly reducing the benefits that all staff may have reaped from a more central decision-making strategy.

Opposite to this, however, is the idea that Salisbury (1996) introduced when he stated that central decision making forces teachers to adapt to their environments to cope with them, rather than transform their teaching. Salisbury implied that a poor use of technology in education is when educators simply adapt to their environments just to keep up, rather than transform their teaching to make it more meaningful. Combining these thoughts with the idea that teaching is meant to be localized and student centered, it may not be possible that such a decision be made from a central location.

A further view is that of Sergiovanni (2000) when he stated that the success of educators is dependent on how much discretion they are given to act in ways that they can best be supported and be involved in continuous learning.

The ideal may not be common to all, but in this study, educators did agree that more technology needed to be in use, if it is operational and problem free. They also indicated that the use of technology had to be meaningful and engaging for the students.

Considering other realities in the workspace of educators, Oliver commented on the real purpose of the teacher, with or without technology, saying, "the computer can't replace the teacher, though. A teacher's job is to motivate, guide, and inspire self-esteem in the students; having the best computer or textbook in front of a student won't motivate the student" (Oliver, p. 20). Geelan (2002) identified some of these issues that educators face when he revealed his thoughts on issues and challenges on the job. Geelan stated, along with Oliver, that attention to all of the other issues must be given or greater initiatives will not succeed. Jeff agreed, saying that, "[The computer] would create more variety, but I would still have to spend time to incorporate technology; I would have to change the way I teach the courses, but time would be essential to adapt to it all" (p. 20).

Greg added that technology "fits in best if it's used as a supplement in regular teaching. The best way to incorporate it is when it becomes part of the flow" (p. 20). These educators were implying that technology is a great tool, but not all the time. Educators must be there to determine what the needs of the students are and what the

best use of technology is. As explained by Armstrong and Casement (1999), a child cannot be placed in front of a machine and be expected to learn on his own.

Kathy, through describing one of the problems that she ran into when attempting to integrate technology in the classroom, presented a valuable point about what she perceived the best practice scenario would be. She addressed that more technology is needed, but that educators also need more curriculum integration training. "We are lacking having two or three people in the division that can go around and offer technological support to teachers to show them what to use the computer for in the classroom…The majority of teachers have the ability to use the computer themselves, but lack the knowledge of how to teach their class" (p. 4). This person would possibly serve as a catalyst, encouraging educators to become more aware of the potential benefits of technology in the classroom, and getting them started on how it can be done. This best practice includes not simply teaching teachers how to operate technology, but how to integrate technology, an area that she feels needs to be developed in the school division.

Interestingly, Kathy's opinion matched Thomson's (1999) opinion regarding how teachers are trained. "School technology planning seldom includes the additional costs required for professional development…" (p. 11). Keenan (2000) also agreed, stating that "training and professional development are key issues for teachers who don't have the time to add technology worries to their other problems" (p. 49). Perhaps Kathy's ideas are a refreshed version of these suggestions, but better suited to the school environment in which she is working.

Summary of themes related to research question #3. From the information shared by the participants, the best practice of incorporating technology in the classroom may be to get the best equipment that you can have, with good software, and have it accessible so that the educator can use it when he sees fit, in flow and sequence, aligned with the students' needs, whenever it is needed. This answer, however, implies that a formula for the best fit would not be standard to all schools, and perhaps not to all educators within a school, rather that each educator makes the best choice for the students that he/she is working with, and the experience and comfort level that he/she has. The question, then, becomes whether or not this application of technology is good enough, and whether or not using technology, which is an instructional method, can be mandated like the curriculum, which is instructional content.

Summary of Themes Related to the Three Research Questions

The objective of this research was to investigate the perceptions of educators regarding the incorporation of technology in education, specifically in the classrooms of both elementary and high schools, with a focus on the three research questions, restated as: the degree that the educator's strategies have been informed by technology; the role that self-efficacy plays in the use of technology; and the educator's perception of the best practice of incorporating technology in the classroom.

It was found that the educators' education strategies have been informed by technological change to the degree that the educator perceived a need. These

educators had a tendency to learn about technology to the level that their students needed, and where they saw a need for or benefit from it. The benefits from technology were identified as accessing resources, improving communication, motivating students, and providing a different way for the students to learn. These benefits were realized with good financial and technical support from the board and the school administration. The change in education strategies, however, is limited due to limitations that technology presents, such as poor information on the Internet, the dependence that students develop on spell and grammar check, and poor research skills. Forces that further impede the use of technology include differences in needs, abilities and economic situations among students, curriculum requirements, time on the job and educators' perceptions of effective teaching strategies.

Educators, however, used their skills in developing relationships with students and attempted to assess their needs, and supplemented education with technology wherever it was appropriate.

Self-efficacy also played a part in the educator's use of technology in the classroom. Most educators felt a high level of self-efficacy in their work as educators, but this self-efficacy varied when technology was considered. This variance is due in part to the experience of the educator, as well as the grades or subjects that they taught. Self-efficacy is influenced by a number of factors and is difficult to assess for the group of educators as a whole. It appeared that educators in the primary years felt a high degree of self-efficacy in teaching their students using technology as generalist teachers. This degree of self-efficacy with technology was reduced in the middle years, but increased again in the high school, possibly since

high school teachers are more specialized and not expected to teach every subject. In high school, then, there is a specialized computer instructor to teach the software while other teachers work in their subject areas and include technology as an assisting tool.

Participants shared their perceptions of the best practice of incorporating technology in the classroom. Although there was a large variance in the answers, most educators felt that more technology could be incorporated in education, but that training to assist with the incorporation was also needed, and that it would be incorporated only if they perceived a need for it. A "one size fits all" solution was not acquired, but most respondents felt that one computer per child was wasteful since attention must also be paid to traditional teaching (pencil and paper) instructional methods. The minimum number of computers in the class appeared to be about five or six, so that some instructional time could be devoted to incorporating technology in education without always needing to book the labs.

The Visual Perception Spectrum

The visual perception spectrum was used at the outset of each interview to attain a pictorial overview of the perceptions of each educator. It is included in Appendix B. This activity included four separate spectrums on which the educators indicated their perception of where they felt they were according to the two opposite dichotomies. The purpose of the spectrum was to get an overall view of the participants' perceptions on one page, as well as a way to compare or triangulate information acquired from the interviews. This spectrum was related to the four

headings in the literature review, thus it provided a clear avenue for which the findings of the research and the literature could be compared.

Spectrum Relating toResearch Question #1: Change

The first spectrum (Figure 6) was related to the educator's perception of how comfortable they were with change. Each educator is represented by their respective letter for the pseudonym used in this thesis, and is included in the participant summary chart at the outset of this chapter.

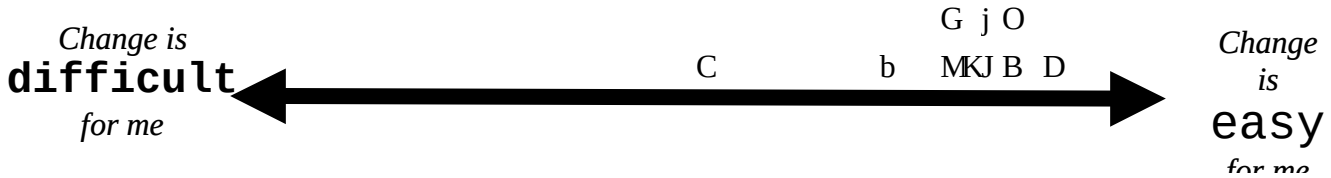


Figure 6 - Change Spectrum

This spectrum visually implies that change is relatively easy for this group of educators. This is related to their responses to interview questions regarding the degree in which their strategies had been informed by technological change, and is sometimes in agreement, and sometimes in contradiction.

The information provided by the participants contradicted what was uncovered in the literature review. Conner (1993) implied that change is difficult for individuals, and, as discussed in the literature review, only a certain amount of assimilation points are available for a person to use up before they find it difficult to assimilate to change. In a given day, it can be assumed that change would be difficult

for educators since educators are immersed in taxing and demanding environments, however, on the visual perception spectrum, these educators have indicated that they are comfortable with change. Perhaps then, educators are generally resilient people (Conner, 1993), and are able to manage a lot of change.

Colette placed herself at the midway point on the spectrum, indicating that she may struggle with change, but she then stated that once she sees it in action and it is working, she will change. This is consistent with the literature indicating that teachers may be resistent to jump on the technology bandwagon. It may also validate Kathy's suggestion that a technology team of experts should visit teachers and model effective technology use. Bedient (1995) argued that educators are unwilling to give up control, thus contribute to an organization that does not lend itself well to change. Colette further challenged this with her statement that she would change to incorporate technology, but she has to understand it, and it has to be better than the paper and pencil tasks (p. 2).

Bernie's view on change agreed with Salisbury's (1996) in the literature. As an administrator, he saw that educators found change difficult if it was not implemented properly. This is why he placed himself closest to Colette on the spectrum related to change. Bernie identified that "teachers are uncomfortable with change so we must develop a very structured implementation plan" (p. 6). Salisbury advised that in implementating change, administrators have to be aware of its impact on all parts of the organization, and perhaps the success of the technology implementation in Bernie's school is that the implemetation is well planned and executed.

Donnie placed himself closest to the right on this spectrum, and asserted that change was easy for him. He is the administrator who felt very comfortable with using technology together with the students, without mastering how it works. He was comfortable learning with the students. Perhaps he is one of Conner's (1993) examples of individuals who are able to dispense only a few assimilation points on various activities.

Further to the left were Jane and Jeff who stated that as educators, they have experienced constant change, thus they have developed a strong ability to be comfortable with change. They shared that as new teachers, they are put into ambiguous situations where their teaching load varies from subject to subject and grade to grade. For them, adapting to change means survival.

During the interviews, participants responded to the question regarding the ways in which technology has changed education by acknowledging that technology has influenced education, but not transformed it, as suggested by Salisbury (1996). Donnie acknowledged, however, that many things are tied to technology, so then we must learn to use it.

Greg divided the changes in technology that affect education into three areas, being administration, communication, and as a supplement to learning. He said that those three areas are distinct in how technology is used. Oliver pointed out that the administrative end of education has changed quickly because of technology, and many things in administration are more convenient, but changes in the classroom are related to information access and presentation materials, and not based on convenience. Similarly, Colette indicated that "technology has given education

another avenue to explore" (p. 5), but not necessarily transformed it. The participants still indicated that this change, although it has made education in the classroom a little different, has not presented them with an insurmountable challenge.

Participants were also asked to indicate how they have changed their strategies to account for the new technology. Some of these responses may contradict the indications on the spectrum, since most participants indicated that they were comfortable with change, but did not feel a need to change. It may also be that there is no contradiction, rather they are comfortable with change, but do not see a value in changing to respond to new technology on a large scale. Matt indicated that "it hasn't changed my teaching strategy as much as I would have liked it to" (p. 5). He then indicated that obstacles such as time, access and resources prevented this from happening. Jane and Jeff indicated that very little change had taken place for them. Jeff admitted, "what I use in class now works well" (p. 6).

Greg, a technology teacher also admitted that his strategies had not changed much. He did, however, get involved in technology because of the need. "I was spending a lot of time working with individual students because they all work at different levels…by having more resources on-line, it allows them to work at their own speed and frees up my time as a teacher" (p. 7).

Comparing the spectrum to responses about how educators had responded to the changes regarding technology in education, it can be seen that educators have noticed the change, and have accounted for the change in various ways, but that their teaching strategies have not changed much because they generally continue to do what they have always done: That is, find resources and materials that best meet their

students' needs, and use them in the most efficient way possible. As Colette identified, to her, technology is a tool, and it is found to be useful in several applications. It has not transformed her classroom, but has a beneficial purpose in teacher-directed applications.

Spectrum Relating to Research Question #2: Beliefs of effective educational practices

Figure 7 indicates pencil and paper to the right, and a port on the left. The participants were to indicate whether or not their beliefs of effective teaching strategies included more technology or more paper and pencil tasks by their placement on the spectrum.

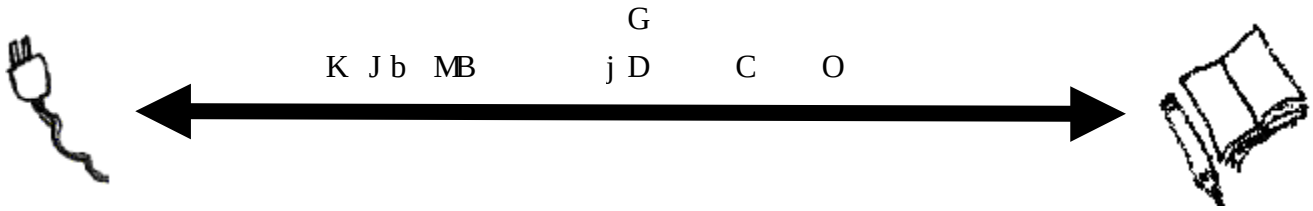


Figure 7 - Educational Practices

Although there is a wide variance in where participants placed themselves on this spectrum, the bulk of them were on the left of center on this line. This may indicate that these educators felt that effective education strategies include more technology in education, whether it is in lesson preparation, instruction, or student use.

Oliver was the closest to the right, indicating that his perceptions of effective education strategies involved more paper and pencil tasks than technology integrated ones. He supported this with the statement that "Computers are a good assisting tool, but kids need to do some paper and pencil stuff; those video games may be the reason why kids are obese. The computer can't replace the teacher" (p. 20). This is in agreement with the literature that supports traditional learning, such as Armstrong and Casement (1999), who argued that the benefits of paper and pencil must not be undervalued and that "schooling, particularly in the elementary grades, should allow children the time to think and wonder and get to know themselves in the real world they live in" (p. 28).

Right in the middle of the spectrum were Greg and Donnie. Greg stated that computers work best if they are a part of the regular teaching environment, part of the flow. It is not necessary to have one per desk. "They should be used much like a book or a chalkboard" (p. 20). This implies that technology is a tool and that there should be a balance between technology and tradition, and that teachers are put in charge to find that balance. Interestingly, Greg is a computer science teacher.

As discovered from the interviews, many educators are cautious to jump into technology without evaluating all of its benefits and drawbacks. This is in agreement with the advice of Jamie McKenzie (2002) who said that "toolishness is foolishness …showering fancy equipment and toys on classrooms without smart planning is unlikely to produce gains in student performance" (p. 1). McKenzie added that wise planning includes looking at the dark side of the venture to predict what might go wrong, and planning for it. He also stated that there is no real harm in delaying

purchases and initiative to learn from the mistakes of others and "avoiding the bleeding edge of change" (p. 9).

On this same spectrum Bryce placed himself closer to the port on the spectrum; however, during the interview, he contradicted himself by saying that "technology is a great tool but it still does not replace paper and pencil or traditional ways" (p. 2). This inconsistency may place added value to the fact that students cannot learn well in isolation (Armstrong and Casement, 1999), even if a computer is involved. What may account for this is that he emphasized the importance of the resource that computers can be, but that technology is not the answer for most students in their day to day learning. He asserted that students need teachers in supportive, personal contact. This concurs with Tapscott (2001), who argued that teachers would not become obsolete with the increase in the use of technology in education, but rather they must learn to take on change in the form of learning a different role. Their new role would evolve from instructor to facilitator, from leader to mentor, and that this would exist in almost every area, and every discipline.

Closest to the left on this spectrum was Kathy, a learning assistance teacher, who had recently discovered supportive ways to incorporate technology into her teaching, and believed that it should be used more, but in an integrated manner, rather than an operational one. She felt that most educators are not yet necessarily all doing this (p. 4).

Kathy's perception was parallel to that of McKenzie (2001) who observed "even after twenty years of bringing these new technologies into schools and offering training, we are finding that a large percentage of teachers report feeling ill prepared

to use them in curriculum rich ways" (p. 4). Kathy and McKenzie (2001) argued that the incorporation of technology is still at an operational level, rather than an integrated one, and without attention to this area, improvements cannot be made. Bryce agreed with them when he said, "Educators are not often taught to integrate technology into their classroom in an effective way" (p. 2).

Spectrum Relating to Research Questions #1 and #2: Technology training

Using this spectrum, the educators were asked to indicate at which level they felt they were trained to use technology in the classroom, being operational, as in being taught to turn on a machine, operate a word processing program and the like, versus integrated, as in being taught to use technology in curriculum integrated, meaningful ways. Their responses are included in Figure 8, which indicates an operational end and an integrational end.

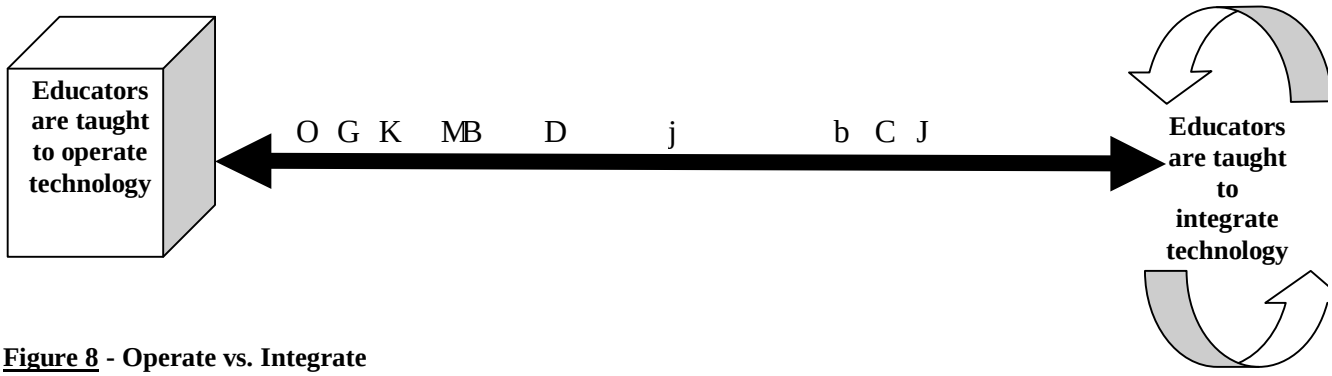


Figure 8 - Operate vs. Integrate

There was a wide range of responses to this question. Jane, who placed herself closest to the integration end of the spectrum, felt she was taught to integrate technology. At the school that she was at before entering this school division prior to

her current contract, she was trained extensively by staff experts. Collaboration was strong among her colleagues, and it was done in curriculum rich ways.

Colette, next to Jane on this spectrum, also shared a similar experience. In her position in this same school division, but at another school, her administration made it a point to provide many curriculum rich in-services about technology integration. She felt the lab at that school was set up to provide curriculum related opportunities for the students, and the support for it at that school was strong. Third to the right on this spectrum was Bernie, a high school administrator. He believed that since technology is a priority at his school, the staff is provided with many curriculum related opportunities to incorporate technology in education. This is in par with Sergiovanni's (2000) work on collaborative cultures. Jane, Colette and Bernie exhibited behaviors consistent with those who experienced empowerment and support, and who worked in environments where decisions and initiatives were shared in collaborative and valuable ways.

Oliver placed himself closest to the left on this spectrum. In his opinion, there are few opportunities to learn how to actually integrate technology with the curriculum. He believed teachers are left to do it on their own. Similar experiences are shared by Greg and Kathy, who were also sitting to the left on this spectrum. Kathy elaborated on these thoughts when she said, "the majority of teachers have the ability to use the computer for themselves, but lack the knowledge of how to teach their class" (p. 4). These comments reflect Keenan's (2000) work on technology in education, saying "training and professional development are key issues for stressed-

out teachers who don't have time to add technology worries to their other problems" (p.17).

These responses lead to the formation of the idea that perhaps the integration of technology in curriculum rich ways is left to the discretion of the school administration. Bernie stated that he makes technology integration a priority, and that helps in the success of the initiative. Donnie agreed, but he also added the following metaphor, describing his role in keeping the technology initiatives alive in his school: "I feel kind of like a dish spinner at a circus – I'm running around getting them all spinning. They go, and some of them I don't need to go back, but others I need to go back and get them spinning again" (p. 1).

If this is the case, it implies that perhaps the literature is correct when implying that boards are not doing their jobs in providing the vision for schools. Even though our nation's teachers are responsible for preparing our students for a technology driven society, school technology planning rarely includes the additional costs required for professional development (Thompson, 1999). Most professional development, according to Thompson, comes in the form of how to operate the technology rather than how to integrate the technology into the curriculum.

Fullan (1993) stated "on one hand, schools are expected to engage in continuous renewal, and change expectations around them…On the other hand, the way teachers are trained, the way schools are organized, the way the educational hierarchy operates, and the way political decision makers treat educators results in a system more likely to retain the status quo" (p.2). From these responses it can be argued that unless these educators received support from their local administration,

the opportunities to incorporate technology in curriculum rich ways, as they are charged to do were perceived to be few.

Spectrum Relating to Research Questions #2 and #3: Self-efficacy

This spectrum, included as figure 9, was intended to get an overview of the participants' perceptions of their ability to make a difference in the lives of their students. Most educators placed themselves very close to the left on this spectrum, indicating they felt they do make a difference.

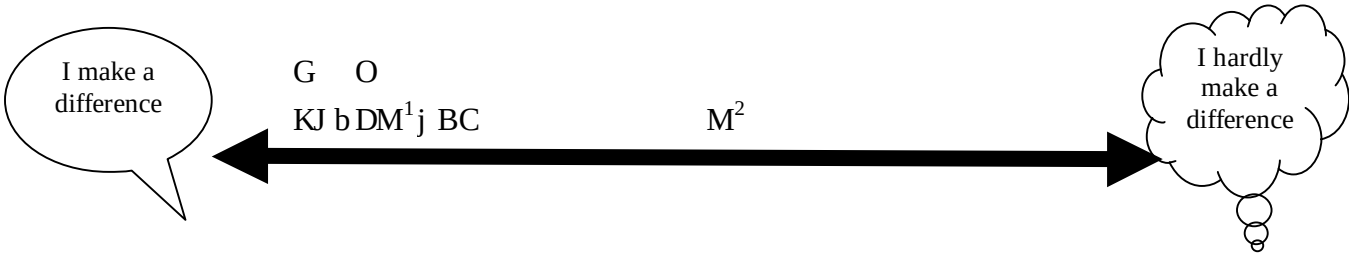


Figure 9 - Self-Efficacy

Matt indicated he perceived two levels of self-efficacy. M^1 was as a classroom teacher, and M^2 was as an administrator. He added that the difference in the two placements existed because as an administrator, he was unable to develop the relationships he could in his position as a classroom teacher, thus felt he made less of a difference in his administrative role. Interestingly, he connected self-efficacy with the interpersonal role of the educator, rather than solely the instructional knowledge of the educator.

These placements imply that these educators, despite issues with technology, felt they made a difference in the classroom. In studying the responses in the interviews, these feelings appeared to come from the relationships that most of the

educators had developed with the students, regardless of the use of technology in the classroom. The interview responses indicated that educators believed that it is the interpersonal contact that makes a difference in the lives of students.

Bandura's (2000) work on self-efficacy revealed "perceived self-efficacy refers to the beliefs in one's capabilities to organize and execute the courses of action required to produce given levels of attainment. Unless people believe they can produce desired effects by their actions, they have little incentive to act" (p. 18). This is parallel to the findings from this study in that educators appeared to be motivated to act if they thought it would make a difference.

Most respondents interviewed said they knew that they made a difference in their students' lives. Matt described the feeling from this as 'charging the batteries'. Donnie also reminded us of the negative phenomenon of Bandura's (2000) processes of self-efficacy, considering technology to be a threat to self-efficacy, when he said "if you know that you have to teach something and you think your students know more about it than you do, you'll avoid it using everything rather than teach it" (p. 8).

Interestingly, most participants placed themselves to the left of the spectrum, indicating they feel they make a big difference in the lives of their students. Considering responses with respect to delivering technology-integrated instruction to the level that their students need, it was observed there was some contradiction to the educators' placements on the spectrum.

Bandura's (2000) selection processes of self-efficacy came into play again, when Bernie indicated "teachers need to feel that they are expert, and I wouldn't put myself in a situation where I had to teach with technology if I didn't feel I was an

expert in it" (p. 10). Oliver, a grade eight teacher, felt he wasn't strong enough to do it, so he opted to switch this responsibility with another teacher and he teaches something else for that teacher at that time. This affirms Bandura's (2000) theory that either educators who feel they cannot offer valuable technology-integrated instruction avoid being put in that position, or that these educators, despite issues with technology, still feel they make a great difference in their students' lives with the other work that they do.

Regardless, this group of educators felt a high level of self-efficacy in their positions, therefore technology in education does not seem to pose a large enough threat to shake them from believing they are not good enough to meet their students' needs.

Summary of the Visual Perception Spectrum

The visual perception spectrum provided another way to gain an understanding of the educators' perceptions regarding all three research questions. From the spectrum, it was learned that despite literature on change, this group of educators perceived that change was relatively easy for them, and that it was practically inherent in the vocation of being an educator. It is possible that this group of educators was more resilient than those studied in the literature since their perception of being capable of assimilating to change is high.

Most educators perceived that technology should be integrated into education more than it currently is. They did, however, agree this must be done in meaningful ways that are curriculum referenced, and planned for success. The reasons that it

currently is not being done vary from poor resources to poor planning, but they generally acknowledged that if they did not see a need for technology integration, nor the potential that it would be successful, they would not spend time on it.

The educators in this study all felt they made a difference in the classroom. It was their perceptions that the connections and personal relationships they had with their students were valued. When asked about their position on the spectrum, many replied that education without personal connection had little value nor chance for success.

Finally, educators varied in their responses to whether or not they have been taught to operate technology at a basic level, or to incorporate it into education at a more meaningful level. This variance was due to the experiences at their schools, and led mostly by the local school administration. This information leads to the notion that technology initiatives are successful due to the efforts and plans of the local school administration versus the plans of the board, thus the operation or incorporation of technology may vary from teacher to teacher and school to school.

Observations

The final information collected from this study was in the form of observations made from the teaching environments in the field. Most participants wished to be interviewed at their school sites, therefore, it was possible to see the environments in which they taught, as outlined in the professional information chart at the outset of this chapter.

At the elementary level, computer access is limited aside from the computers in the classrooms observed. This may support Oliver's statement that "if there were computers in the classroom, I could get out of the lab where things aren't working" (p. 20). He added that in the lab, way too many problems arise, "even if you can get in there" (p. 15). His frustration was also shared by Colette, who affirmed that in her lab, "you're given half an hour of computer time and sometimes it takes ten minutes to fix things" (p. 15). These problems limited what elementary educators can do with their students, possibly leaving the greatest benefits of technology in education to come from teacher access to resources and communication to other educators.

In the high schools, it appears that the classrooms are also poorly equipped with technology, as Jeff noted, "because of lack of funds, it's not realistic [to have more computers in the classroom], but it would be good if there were some to be shared" (p. 4).

This lack of computers in the classroom, however, is partially overridden with the great labs, and a full time computer teacher. In the high school setting, this teacher's job is to teach technology, and he has a great machine at his desk onto which he can create lessons, and assist students at the same time. The library is also well equipped with research computers in the room, and a library classroom under development that will be used for further research and instruction. The teacher librarian is also very skilled in technology education, thus at this high school in particular, the lab and the library present potentially outstanding opportunities for meaningful technology integrated instruction.

Summary of the Interviews, Spectrum and Observations

The interview segment, visual perception spectrum and the observations all contributed to answering the research questions. To briefly summarize, it was found that these educators' strategies have been informed by technological change, but to varying degrees, and pertaining to the levels that educators perceived a need. There are forces that promote or inhibit the use of technology in education that are beyond the educator's control that influence this change, and the perceived impact of these forces also influenced the degree that the educators' strategies have changed.

Self-efficacy played a large role in the use of technology. Most educators felt they made a difference in the lives of their students, and this self-efficacy fueled them to stay motivated. Self-efficacy in teaching versus self-efficacy in teaching technology, however, are not the same and vary according to experience, the educator's position and the grades and subjects taught.

The educators' perception of the best use of technology in the classroom varied according to the perceived need for technology and the anticipation of whether or not the use of that technology will be successful. The educators did, however, all perceive that more technology could be incorporated in education, but it would have to be meaningful, operational and integrated.

The spectrum activity confirmed much of what was found during the interviews, and related the research to the literature. Educators, despite literature, perceived themselves as able to adapt to change. They also perceived themselves as making a difference in the lives of their students despite the pressure to teach using technology.

The spectrum, however, revealed a variance in preferred teaching strategies, being traditional versus technological. There were reasons for this variance, including success and frustration stories, and the perceptions of whether or not technology would serve as a valuable tool for teaching students.

Finally, educators also varied in their responses to whether or not they were trained to operate technology versus trained to incorporate technology into the curriculum. Participants who reported that they were offered integrated training, were taught by colleagues at their school sites. Administrators also reported they trained staff to use technology in an integrated manner, but that it was through their own initiative, rather than directed by the board.

In observing the workspaces of the educators who participated, it was apparent elementary schools are fitted with one to two older computers in the classrooms, and one lab with about thirty newer computers. Most teachers in the elementary taught their own computer classes. The high school was fitted with one teacher computer per room, but with two labs of approximately 32 computers each, and a well-equipped library with over a dozen research computers and a library classroom under development.

These observations led to the conclusion that the elementary educators, mainly generalist teachers, were responsible to offer technology-integrated lessons to their students, but all shared one lab, and had only one to three computers in their classrooms on which to do this. High school teachers were responsible for their specific subject areas, and had little access to computers, apart from booking the library for research classes. The bulk of the technology in the high schools was the

responsibility of the computer science instructor and the teacher librarian, who had a great deal of expertise in their fields.

Chapter 5

Discussion and Implications

The objective of this research was to investigate the perceptions of selected educators regarding their incorporation of technology in education, comprising of K-12 schools and their institutions. This research was conducted in the classrooms of both elementary and high schools, with a focus on three research questions including the degree that the individual educator's strategies have been informed by technological change, the degree that self-efficacy has played in the educator's use of or lack of use of technology in the classroom and the educator's perception of the best practice of incorporating technology in the classroom.

This was an effort to bring forth the educators' voices in a longstanding debate regarding the comparison of the use of technology in society versus in education. It was anticipated that by gaining an understanding of the educators' perceptions of the use of technology in education, perhaps this debate might be partially resolved.

Interview Discussion

In answering these questions, ten educators were interviewed using a semi-structured format, and much dialogue took place. The data analyzed in the previous chapter summarized the responses, and this chapter attempts to elaborate further on that information according to implications under each research question.

The Affect of Technology on Education

The first research question, to what degree have the educator's strategies been informed by technological change, brought about information from these ten educators that there has been a great deal of change in education because of technology. These changes fall into two categories. One is the change that has taken place in the administration of schools with respect to technology, and the other is the change that has taken place regarding curriculum and instructional methods with respect to technology. It is only when we divide educational institutions into two separate areas, administration and education, that education can be compared to business and society in how it has responded to technological changes. Tapscott (2001) proposed that profound changes were needed in education when he criticized that educational institutions have undergone very little change with regard to technology when compared to their counterparts in business and society.

To elaborate on the areas of administration versus education, one could say that in education, technology is used for administrative purposes much in the same way as it is used in business. The administrators and administrative assistants have computers for memos, newsletters, communication and reporting, as do the teachers for attendance and creating letters, assignments and other word processing applications. The two can be compared.

The differences, however, come into play when critics consider how technology is used in the classroom, and this cannot be compared to the uses that businesses have for technology. The success of education often operates on

interpersonal relationships. Student education would not be as successful if students were working in cubicles, similar to many business environments.

The educators in this study revealed that technology was being used to improve education. The example of the s-waves and p-waves, the special needs students working on a program to help them communicate, the presentations on PowerPoint to respond to assignments given in class, and the exciting lessons taught through simulated environments are not just examples of technology being used in education, rather they are examples of teachers using what they have around them to deliver the best education to the students that they have built relationships with in the classroom setting. The rest of the education occurs outside the technology circle – learning respect, integrity, and independence in community with other learners.

Consider the analogy of a car dealership. Technology is used to build the cars, create the pamphlets, make the advertisements, do payroll, etc., much like a school uses technology to build the lessons, create memos, write letters home, take attendance, but the real selling of cars occurs without a computer, on the showroom floor, person to person, much like the educator delivers lessons in the classroom, teacher to student.

This discussion will now move past the initial criticisms that schools fail in comparison to business since the argument requires that the institutions be the same. The information gathered from these educators reveals that schools and businesses are not the same in the ways that they operate, nor in their purpose, thus they will no longer be compared for the purpose of this study. Moving to the focus of the research question – how individual educators' strategies have been informed by technological

change – requires that the discussion be focused on how educators use this technology at work in their curriculum and with instructional methods.

In the elementary schools, technology is being used predominantly to familiarize students with computers and how they operate. Most classrooms have one or two computers available for the students to use, thus the bulk of the computer work occurs in the lab on a weekly schedule. Students do a variety of activities to acquaint themselves with the machines.

Technology is also beneficial for students with special needs. It is here that, beyond getting the students accustomed to computers, the introduction of technology may make a great difference. Technology appears to offer the integrated special needs student with a little more than the teacher can, either through motivation, programming, or communication and the teachers in this study sought to find materials, which allow this to happen for these children.

In the high schools, the educators in this study painted the picture that in the regular classroom in core subjects, technology is used as a support, either for the teacher to access materials or for the students to access information in the form of research. Computer science and technology lessons occur, in bulk, during the computer science classes or during library research classes, where specialized teachers, highly knowledgeable in those areas, provide meaningful and valuable lessons to students.

In response to literature in this area, this study revealed that these educators were not likely to resist the change that technology offers. In fact, most were hoping to get an opportunity to use it more. Great changes in education, however, are easily

observed in the way education is administered. Teachers communicate by e-mail, do attendance on-line, search for resources on the web, run resources off disks, present material using PowerPoint, and often assign research projects encompassing Internet sites and resources. The real obstacles to its use in instruction are centered on the common issues of the workspaces of the educators: time; resources; equipment; and opportunity to learn.

These educators also felt supported by their board. There is a rotating budget allotted for technology, technicians are available to help, and some resources exist to encourage the use of technology in education.

Perhaps some of the problems identified in literature through Salisbury's (1996) work on systems theory are that the hierarchical nature of the decision making in this school system prevents more effective decisions being made regarding the use of technology in the classrooms, but as Bernie identified, more decision making is being left to the local school administration to allocate resources in technology where they see fit. Kathy also added that it would be beneficial to have one or a team of educators available to model and assist other educators in implementing curriculum-rich, engaging technology centered activities for students, but this has yet to happen, and Bernie stressed the importance of teachers seeing the technology modeled in order for teachers to take it on in their classrooms. Putting all of these suggestions together, perhaps such a team would be ideal for this system.

These educators, however, almost all stated that technology does not replace the teacher. In their interview answers, many identified they made a difference because of the rapport they had with the students, because of the expectations they set

out, or because their students knew they cared. As Oliver cleanly stated, "One-to-one contact in the classroom is more beneficial to an individual than the latest and greatest computer program or the presentation method" (p. 21).

The Affect of Self-Efficacy on the Educator

The second research question, to what degree has self-efficacy played in the educator's use of or lack of use of technology in education, provided information regarding how able these educators felt they were in teaching technology or delivering technology integrated lessons.

All educators in this study felt a high level of self-efficacy regarding their ability to teach and make a difference in their students' lives without regard for technology. When considering technology, however, some educators felt very comfortable in delivering technology integrated lessons to their students, and were required to do so, while others felt they were somewhat comfortable with it, but did not have to use technology much in their teaching. This appeared to be dependant on the grade level the teacher was assigned to teach. The interviews revealed there may be a larger onus on those educators in elementary education to sharpen up in the computer lab, since they are generalist teachers, required to teach in all subject areas weekly, while those educators in high school were not required to use technology on a weekly basis. The technology tasks are generally left to the specialist teachers in the high school.

It was then noticed the two middle years educators in this study felt the least comfortable with delivering technology integrated lessons, perhaps because they had

older students than their colleagues in the primary years, and could not rely on technology specialists as in the high schools. The model, presented in Chapter Four, suggests that perhaps a specialist in the area of technology is greatly needed in the middle grades (6-8) in the elementary schools.

The element of self-efficacy was difficult to assess with regard to technology, however, because technology is often not the problem in itself, rather it is the fact that the technology is not perfect and the breakdowns that accompany its use are often the reason why educators felt they were not good at it.

The Best Practice of Incorporating Technology in Education

The third research question, what has been the best practice of incorporating technology in the classroom, encompassed a large variance in responses. In sitting through the wait time during this question, this researcher sensed this question implied there is no way the participant could have reached the best practice already, thus had to think up another solution. This spliced thoughts into two directions. The initial thought is there is a best practice out there that the educator is trying to attain, but the second is that the educator is always striving to provide the best for his students, thus the best practice may always be occurring and changing on a daily basis in the classroom.

Most participants answered the question along the lines of equipment needs. They alluded to the idea that there are still obstacles preventing them from using technology to its fullest, but it was during the third interview with Jeff that this researcher worded the question less presumptively, and added “or is it attained” or

something of the like to the tail end of the question to remove the presumption that the educator has not met some standard. During that interview, a question was elaborated to include "what would you do if you walked into a classroom and there was a laptop on each desk?" Jeff's humorous reply was to run away. It was then that the researcher understood that this question possibly made the participant look to something more than what he needed or even wanted, and although Jeff praised technology, he would never consider this kind of equipment in an ideal situation.

Considering the first thought, that there is a best practice which these educators have yet to attain, most educators replied that more technology was needed. Other replies included time, training, and modeling.

Considering the second thought, that the ideal is met on a daily basis, as indicated in chapter three, the best practice of incorporating technology in the classroom may be to get the best equipment you can have, with good software, and have it accessible so that the educator can use it when he sees fit, in flow and sequence, aligned with the students' needs, whenever it is needed. This may look different in all schools, and in all classrooms, but it allows for each educator to make the best choice for the students he is working with, and at the experience and comfort level he has.

As indicated in chapter 4, then, the question becomes whether or not this use of technology is good enough, and whether or not using technology, which is an instructional method, and usually personal, can be mandated like the curriculum, which is instructional content and governmentally regulated.

Post-Research Conceptual Framework

The conceptual framework presented in Chapter Two of this study presented an overview of the research questions as they pertained to the literature review. Following the data collection and analysis, the conceptual framework at the outset of the study was no longer adequate in describing the perceptions of educators regarding technology in education, thus a post-research conceptual framework is presented as figure 10.

This second conceptual framework allots for the decreased use of the word 'education' and an increase in the use of the word 'classroom'. Using the word 'classroom' appeared to be more fitting as the research evolved. Since most educators referred to change, self-efficacy, and their beliefs as they pertained to their own classrooms, it became less relevant to imply that their answers pertained to education in general. Despite this change, the word 'education' had not been removed completely, since at times, participants referred to elements outside the classroom, such as the board, and policymakers, thus a larger educational framework was needed.

Differing from the previous framework, this figure no longer includes arrows. The reason for this is it was found that none of the areas studied was independent from one another. That is, the way the educator managed change was dependent on his/her level of self-efficacy, the conditions at his/her workplace, and his/her beliefs of effective educational practices. Likewise, it was also found that the current use of technology in the classroom could not be portrayed as linear with the 'best practice' as an ultimate goal since, it was found that many educators in this study believed they

already did employ the best practice of incorporating technology in education, and they would modify it as they see fit, if and when technology use is deemed practical and useful.

Highlighted on the post-research conceptual framework are the four areas of literature, with the major findings related to the three research questions beneath each. Not all points are included, therefore this framework is not exhaustive, however, the major findings are abbreviated for discussion.

In studying the effects of change on the educators, it was found that this group was rather resilient to change, that an effective implementation of change is key to its success, and that the educators realized technology has changed education, but it has not transformed it.

This group of educators reported they value a balance between technology-oriented instruction and traditional paper and pencil instruction. They noted that, from their experience, the interpersonal nature of education is invaluable to the students and it cannot be replaced by technology. This group also indicated that although technology can be useful in education, its employment is evaluated each step of the way, and if its incorporation is not perceived to be a valuable addition to the curriculum, educators are unwilling to invest time into employing it.

The conditions in educational institutions was also included in this study, and the participants in this research concurred that time, money and stress are issues in education, thus current professional development involving technology is often fragmented, and aims at adapting to technology, rather than using it in curriculum-rich, curriculum-integrated ways. Technology is used similarly in businesses – for

bookkeeping, attendance, correspondence, and the like, but differences arise when it is used in education, as its applications cannot be paralleled to business.

These educators did, however, praise the technology department in their division for the work they do, and recognized they are doing the best they can with what they have to work with. This results in realistic expectations regarding what technology will do for them and their students.

Lastly, the educators interviewed reported they felt a high level of self-efficacy, regardless of their level of technology expertise. Many stated it is the interpersonal nature of the job that allowed them to make a difference in their students' lives and this is independent of technology initiatives, and will continue to be that way.

This framework is an abbreviated visual interpretation of the areas researched and the findings of this study. Much discussion can be elaborated upon these points alone, and over time, this discussion will change. It is important to remember that the educator was central to the study in the original conceptual framework, and continues to be following the study. It is this person who strives to match the information and resources available to him/her to best meet the needs of the students whose lives he/she is to touch.

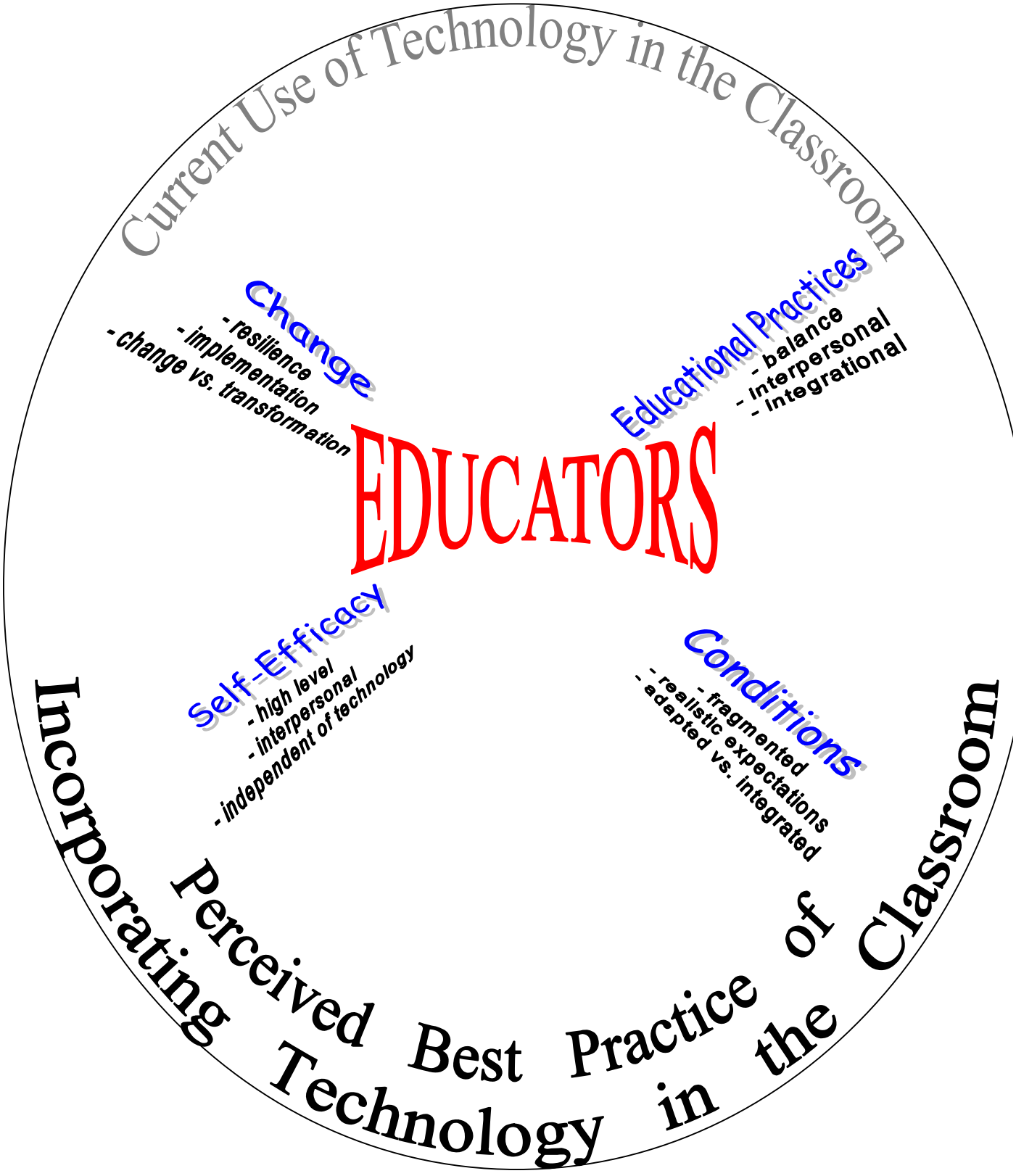


Figure 10 – Post-Research Conceptual Framework Diagram

Summary

This study brings to discussion several perceptions held by educators regarding the use of technology in schools and classrooms. The first is that technology has influenced education in two distinct areas – administration, and education in the classroom. In administration, it was being used much like it would be in business. In education, it was being used in the ways in which these educators see the best fit. Technology is not used for technology's sake, but rather when it is needed and deemed useful. It is not used when it is impractical either for the educator or the student to do so. This can be considered as an educator's response to the questions regarding why a gap exists between the use of technology in society and the use of technology in education. Technology has been incorporated into education much like in society – in areas where it is deemed effective.

The primary educators in this study felt very confident to deliver valuable technology-integrated lessons to their students, as were the specialized high school teachers. There appears, however, as described in chapter four, to be a gap in the grades six to eight area, where the duties and the confidence of the teachers do not match. Perhaps it is in these areas in which a specialized teacher would be most beneficial.

Technology is a great fit for special needs students. These students are often offered programming and motivation that they would otherwise not have without the technology.

The best practice for incorporating technology in the classroom may look different in every classroom and in every school. It might be possible that this best

practice has already been reached and is ever changing in the classrooms of these educators who strive, on a daily basis, to provide the best for their students. It is inappropriate to assume that classrooms should look like businesses or like society, or that they should look all the same. Classroom environments are tailored to the students in them, and to their specific needs. There is no one-size-fits-all formula to this problem.

The educators in this study used technology in ways in which they were comfortable. Several comments revealed that educators felt comfortable with practices they saw employed or modeled that were effective in educating the students. Based on this, it may be beneficial to have a team of educators circulate and model technology-integrated lessons for teachers, if they wish to have such a presentation. That way, they have the opportunity to see what works and how to do it, and may have a greater tendency to try it themselves.

Important to note, however, is that all educators alluded to the idea that technology can never replace the teacher. It is the personal relationships in the classroom that makes the difference in a student's life.

Implications

Implications for Theory

Hodas (1993), Keenan (2000), and McKenzie (1993) mentioned that the general public is concerned with the gap that exists between the use of technology in schools and the use of technology in society. This research contends that there may be little need for concern regarding this gap. The educators in this study emphasized

that they were aware of the influx of technology in society, but that technology is not necessarily always appropriate for schools. Perhaps an implication for theory in this area is to lessen the focus on the gap, and to increase the focus on how technology is being used successfully in schools.

Conner (1993) indicated that the implications of change are difficult for many people in his discussion on the human response to change. This research revealed that change did not appear to have as great a negative effect on the educators in this study as Conner predicted. An implication for theory may be that educators approach change differently, perhaps due to the nature of their work and the expectations placed upon them.

Implications for Practice

Participants in this study indicated that they have been trained how to use technology, but had little training or opportunity to learn how to integrate technology into the curriculum. Perhaps consideration should be given to the development of a team of "integration specialists" that would model or assist educators in integrating technology into the curriculum.

The educators in the middle years indicated that they did not feel as comfortable as those educators in the younger grades in delivering technology-rich instruction. Responses provided through this research indicate that consideration into the use of a technology specialist teacher in the middle years grades may be beneficial.

Data collected from this study also indicate that perhaps attention needs to be paid to pre-service teacher education. A focus on teaching, observing, or planning for the integration of technology rather than just the operation of technology may assist future educators in serving students' needs.

Implications for Future Research

This study considers the degree that technology has informed the teaching strategies of a group of educators, the degree that self efficacy has influenced the use of or lack of use of technology in the classroom, and the perceived best practice for the use of technology in the classroom. Many questions arose as the research took place and the analysis was completed.

Implications for research include:

1) Research into the practice of delivering technology-integrated lessons in schools in an attempt to determine some of the best practices that could take place;

2) Research into the pressures educators may feel from society in delivering technology-integrated instruction despite what their beliefs of effective educational practices are;

3) Research into the best uses for technology for special needs students, perhaps including a communication web among students and teachers to create a community of learners via on-line communication.

4) Research into the use and benefits of a group of 'integration specialists' to model or assist in technology integration, as well as a look into the use of a technology specialist teacher in the middle years.

Conclusion

Participants in this study shared experiences that were similar to some of the literature researched, but there were also contradictions as well. Despite literature claiming that educators are resistant to change, this group seemed to embrace it. Literature claimed that educators avoided technology, but this group used it if it improved the way they could deliver their instruction. Finally, these educators generally felt they were doing a good job in delivering technology-integrated lessons to their students, despite the criticisms from various authors.

It was found that education and businesses cannot be compared, rather the administrative component of educational institutions can be compared to business, but the delivery of education is not comparable, thus should not be considered as failing in its delivery to the students.

Lastly, technology is important in education, and the best practice of incorporating technology in the classroom may already exist, depending on the teacher, the class make-up and the needs of the students. Most importantly, however, is the point that technology can never replace the teacher. It is the personal interaction, connection and relationships that make schools the important and valuable institutions, which is still what makes the biggest difference in the lives of students today.

References

Anderson, D. P. (1995). Help wanted: Educational entrepreneurs. In D. R. Walling (Ed.), *At the Threshold of the Millennium* (pp. 57 - 64). Bloomington, Indiana: Phi Delta Kappa Educational Foundation.

Armstrong, A., & Casement, C. (1998). *The child and the machine: Why computers may put our children's education at risk.* Toronto: Key Porter Books Limited.

Armstrong, A., & Casement, C. (1999). The case against computers: Why they don't belong in elementary schools. *Quill-and-Quire, 65*(10), 28.

Auer, R. (2001, Fall, 2001). Computers in the classroom: An untested love affair. *ATA Magazine, Fall 2001,* 6-14.

Bandura, A. (1997). *Self-Efficacy: The exercise of self-control.* New York: W. H. Freeman and Company.

Bandura, A. (2000). Self-Efficacy: The foundation of agency. In W. J. Perrig & A. Grob (Eds.), *Control of Human Behavior, Mental Processes, and Consciousness* (pp. 17-33). Mahwah, New Jersey: Lawrence Erlbaum Associates, Publishers.

Bedient, D. (1995). Can educators give up control of learning? In D. R. Walling (Ed.), *At the Threshold of the Millennium* (pp. 77-80). Bloomington, Indiana: Phi Delta Kappa Educational Foundation.

Bennett, H. (2003). Successful K-12 technology planning: Ten essential elements. *Teacher Librarian, 31*(1), 22.

Berge, Z. L., & Mrozowski, S. E. (1999). Barriers to online teaching in elementary, secondary and teacher education. *Canadian Journal of Educational Communication, 27*(2), 125-138.

Bogdan, R. C., & Biklen, S. K. (2003). *Qualitative research for education* (Fourth ed.). Boston: Pearson Education Group, Inc.

Breuleux, A. (2001). Technology and the renewal of teaching and learning. *Education Canada, 41*(3), 12-15.

Butler, S. *Note-Books, 1835-1902*. Retrieved November 12, 2003, from http://www.quotegarden.com/language.html

Conner, D. R. (1993). *Managing at the speed of change*. New York: Villard Books.

Cuban, L. (1990). *Teachers and machines: The classroom use of technology since 1920*. New York: Teachers College Press.

Cuban, L. (1996a). Myths about changing schools and the case of special education. *Remedial and Special Education, 17*, 75-82.

Cuban, L. (1996b). Techno-reformers and classroom teachers. *Education Week on the Web, 16*(6), 1-4.

Cuban, L. (2000). Taking stock: What does the research say about technology's impact on education? *Technology and Learning*, 1-4.

Fraser, K. (1999). ATA sets policy for integrating technology in education. *ATA Magazine, 80*(1), 36-38.

Fraser, K. (2001). Reclaiming the ground: The heart and soul of teaching. *ATA Magazine*, 50-51.

Fullan, M. (1993). Why teachers must become change agents. *Educational Leadership, 50*(6), 1-8.

Fullan, M. (1998). Education reform: Are we on the right track? *Education Canada, 38*(3), 4-7.

Fullan, M. (2002). The change leader. *Educational Leadership, 59*(8), 16-20.

Hargreaves, A., & Fullan, M. (1992). *Understanding Teacher Development.* New York: Teachers College Press.

Hargreaves, A., & Fullan, M. (2000). Mentoring in the new millennium. *Theory into Practice, 39*(1), 50-56.

Hewitt, J. (2000). Computers in the classroom: Successes, failures, future role. *Orbit, 31*, 33-36.

Hodas, S. C. (1993). Technology refusal and the organizational culture of schools. *Education Policy Analysis, 1*(10).

Johnston, T. (1999). Despite technology, the role of teachers in educating children is key. *ATA Magazine, 80*(1), 2-3.

Judah, M. L. (1999). Technology integration: Ready or not, here it comes. *ATA Magazine, 80*(1), 17-20.

Keenan, T. (2000, October 6). Some schools really do get it: There are teachers out there who really understand the potential of technology. *ComputerWorld - Canada, 16,* 17.

Koblitz, N. (1996). The case against computers in k-13 math education (kindergarten through calculus). *The Mathematical Intelligencer, 18*(1), 1-9.

Lewin, K. (1958, Villard Books, New York, 1993). Change is a process. *in Conner, Daryl R. Managing at the speed of change.*

McKenzie, J. A. (1993). *Administrators at risk: Tools and technologies for securing your future*. Bloomington, Indiana: National Education Service.

McKenzie, J. A. (2001). How teachers learn technology best. *From Now On - The Educational Technology Journal, 10*(6), 1 - 14.

McKenzie, J. A. (2002). TechSmart: Making discerning technology choices. *From Now On - The Educational Technology Journal, 11*(8), 1-10.

McKenzie, J. A. (2003). The technology presumption: Could integrating technology sometimes be wrong-minded? *From Now On - The Educational Technology Journal, 12*(9), 1-9.

McNeil, P. (2000). Notebooks score high in the classroom. *Computer-Dealer-News, 16*(4), 34.

McRoy, R. G. (1994). *Qualitative research.* Retrieved November 1, 2003, from http://www.uncp.edu/home/marson/qualitative_research.html

Meyer, K. A. (2003). 'No significant difference' is old news. *Distance Education Report, 7*(2), 1-2.

Nelson, F. A. (2001). Technology for what? *Education Canada, 41*(3), 38-39.

Reid, S. (2002). The integration of information and communication technology into classroom teaching. *Alberta Journal of Educational Research, 48*(1), 30-44.

Roszak, T. (1997). Dumbing us down. *ATA Magazine, 78*(1), 11-14.

Rothenberg, D. (1998). How the web destroys student research papers. *The Education Digest, 63*, 59-61.

Rubin, H. J., & Rubin, I. S. (1995). *Qualitative interviewing*. Thousand Oaks, California: Sage Publications.

Salisbury, D. F. (1996). *Five technologies for educational change*. Englewood Cliffs, New Jersey: Educational Technology Publications.

Schofield, J. (1999). Welcome to the wired classroom: Is it a brave new world or a threat to the learning environment? *McLean's Toronto Edition, 112*(36), 28.

Sergiovanni, T. J. (2000). *The Lifeworld of leadership: Creating culture, community, and personal meaning in our schools*. San Francisco: Jossey-Bass Publishers.

Setzer, W., & Monke, L. (2001). Challenging the applications: An alternative view on why, when, and how computers should be used in education. In R. Muffoletto (Ed.), *Education & Technology: Critical and Reflective Practices* (pp. 141-172). Cresskill, New Jersey: Hampton Press, Inc.

Sheppard, R. (1998). March of the laptops: Is technology overtaking the classroom? *McLean's Toronto Edition, 111*(44), 86.

Slowinski, J. (2003). Becoming a technologically savvy administrator. *Teacher Librarian, 30*(5), 25-30.

Smita, G. (2003). Are we all technically prepared? Teachers' perspective on he causes of comfort or discomfort in using computers at elementary grade teaching. *Information Technology in Childhood Education*, 317-349.

Stiff-Williams, H. R. (2002). Get their attention. *Principal Leadership (High School Ed.), 3*(3), 18-20.

Stockwell, T. Retrieved November 13, 2003, from http://www.state.me.us/education/iasa/title1a/quotes.htm

Tapscott, D. (2001). Educating in a digital world. *Education Canada, 41*(1), 4-7.

Thompson, S. (1999). The challenge of getting IT into schools. *Technology in Government, 6*(6), 11.

Tsantis, L. A. (1991). Technology as the catalyst. In D. Dickinson (Ed.), *Creating the Future: Perspectives on Educational Change* (pp. 140 - 145). Bucks. UK: Aston Clinton.

Tuinman, J. (2000). Educational technology: the answer to a fundamental educational agenda. *Education Canada, 40*(2), 24-27.

Tunison, S. (2003). "A place among the fossils": Using metaphors from imaginative literature to manage change in our schools. *McGill Journal of Education, 38*(1), 79-91.

Usdan, M. D. (1995). Education for the 21st century. In D. R. Walling (Ed.), *At the Threshold of the Millennium* (pp. 13-23). Bloomington, Indiana: Phi Delta Kappa Educational Foundation.

Wang, Y., Trattner, H., & Carter, A. (2000). Information technology in education. *Education Today, 12*(3), 34.

Warschauer, M. (1996). *Motivational aspects of using computers for writing and communication*. University of Hawaii: Second Language Teaching and Curriculum Center.

Wepner, S. B., Ziomek, N., & Tao, L. (2003). Three teacher educators' perspectives about the shifting responsibilities of infusing technology into the curriculum. *Action in Teacher Education, 24*(4), 53-63.

Williams, B. (1993). Barriers to new technology - Part one: Staff balkanization. *From Now On - The Educational Technology Journal, 4*(1), 1 - 12.

Appendix A

Ethics Application

Board of Ethics Approval

Letter for Permission to Access Sample

Introductory Letter - Sample

Consent Form for Participation

Consent Form for Data Transcript Release

University of Saskatchewan Advisory Committee on Ethics in Behavioral Science Research

Application for Approval of Research Protocol

Researcher's Summary:

Advisor: Dr. Keith Walker

Department: Educational Administration

Student: Michelle Prytula, for M. Ed. Admin.

Anticipated Start Date of the Study: January 2004

Anticipated End Date of the Study: June 2004

Title:

Ctrl-Alt-Change: Educators' Perceptions of Technology in Schools.

Abstract:

The purpose of this study is to explore educators' perceptions of technology in education, with a focus on the following research questions:

1) To what degree has the educator changed his education strategies to respond to new technologies?

2) To what degree does self-efficacy play in the educator's use of or lack of use of technology in the classroom?

3) What is the educator's perceived ideal incorporation of technology in education?

Funding:

This study partially self-funded and partially funded through the department of Educational Administration, University of Saskatchewan.

Participants:

The proposed method is to gain access to an urban school division to conduct semi-structured interviews with ten educators (five elementary and five high school educators). Using purposive sampling, the researcher will select ten participants from the network of colleagues that she has become familiar with over the past eight years. Purposive sampling is fitting because of the need to obtain rich, useful data suitable for the research questions. Random sampling is not necessary since the data will not be generalized over a large population. The relationship of the researcher to the participants will not be a dependant one, therefore, no threat or pressure to participate exists.

Confidentiality:

The researcher will ensure participant confidentiality through the use of pseudonyms and alternate location names. Participants may withdraw at any time or refuse to answer any questions without coercion or penalty.

Research Methodology:

The semi-structured interview sessions will consist of two segments. The first will be to have the participants complete a spectrum on which they will indicate their perceptions of various aspects of the technology and education. Following the chart activity, the researcher will conduct a semi-structured interview with each participant using overarching questions pertaining to technology and education and related issues (See appendices A & B).

Interviews will last approximately one hour, and will be tape recorded and transcribed, following the participation acknowledgement with the Consent Forms. Interviews are intended to be a one-time interview, at their school site and during out of

school time, so that it does not interfere with their assigned duties. If another interview is desired, the researcher will ask the participant's permission and will remind them of their rights to withdraw or refuse to answer certain questions. A copy of the transcriptions will be provided to the participants along with the Data Transcript Release Forms. Access to the administrators will be obtained through the director or superintendent. (See appendix A – Request for Access, Introductory Letter, Consent and Data Transcript Release Form).

Storage of Data:

All data (tapes, transcripts, and charts) will be securely stored and retained with the advisor, Dr. Keith Walker (966-7623), in the Department of Educational Administration for a minimum of five years at the University of Saskatchewan in accordance with the University of Saskatchewan guidelines.

Dissemination of Results:

The results of the research will be presented in a thesis as partial requirement for the degree of Masters in Educational Administration at the University of Saskatchewan. The results may also be shared in presentations, conferences or later published in a scholarly journal.

Risk or Deception:

The risks to the participants are minimal. Participants will be made aware of the purpose of the study and why they have been asked to participate. Interviews will be transcribed and a Letter of Consent for Data Transcript Release will be used for the permission to use the information on the charts and the interview transcriptions. Deception will not be used. Anonymity and confidentiality will be maintained throughout the study by using pseudonyms for the real names of the participants or their

schools, or other particular descriptors on the tapes, transcripts, analysis and any written summaries, which result from this study other than the consent form.

Withdrawal:

All participants will be informed that they are free to withdraw at any time or they may shut the tape recorder off or choose not to answer particular questions. If a participant withdraws from the study, they will be informed that it will be without penalty and that all data collected will be destroyed.

Debriefing and Feedback:

Personal transcriptions, collated summaries of the transcribed data (with pseudonyms), and copies of the findings will be made available to each participant who is interested.

Required Signatures:

_____	_____
Dr. Keith Walker, Advisor	Date
_____	_____
Dr. Patrick Renihan, Department Head	Date
_____	_____
Michelle Prytula, Researcher	Date

Contact Information:

Michelle Prytula
343 Skeena Crescent Saskatoon, SK S7K 4G9
Ph: 242-5973 Fax: 242-5973 e-mail: mprytula@scs.sk.ca

Request for Access to do Behavioral Research - Sample

Dear Director;

Thank you for considering this request to allow me to continue my research titled: Ctrl-Alt-Change: Educators' Perceptions of Technology in Schools. This study will explore the how and why educators are using technology in education, how and why they are not using technology in education, and their perceived ideal incorporation of technology in education.

I am seeking to interview ten selected educators - five high school educators and five elementary school educators to get an idea of their perceptions toward technology and change, and their perceptions surrounding issues that accompany technology in education. I will choose these participants from my network of colleagues and will ask them to take part in an interview, at their school, out of school time so that it will not conflict with their assigned duties. I anticipate that each interview will last about one hour, and anticipate that all interviews will take place during the month of February 2004, at the educator's convenience.

I will take great care to ensure that the privacy and confidentiality of all participants will be preserved using pseudonyms, and will only ask them to participate on a voluntary basis. I will also try to be as unobtrusive as possible, and will ask each educator to complete a small spectrum activity and a semi-structured, recorded interview. Participants will be made aware of the purpose of the study, and will have the option of withdrawing from the study if they choose.

Each participant will also be provided with a copy of their data and transcripts, as well as a copy of the results of the study. The results of the study will be used for my thesis, and may later be published in a scholarly journal, used for a presentation or at a conference.

I ask your cooperation by allowing me access to these individuals by confirming and signing this form, and if possible, endorsing/supporting my study to these educators. Thank you for your support!

Michelle Prytula Researcher University of Saskatchewan	Director of Education	Date

Introductory Letter - Sample

Dear Educator;

Thank you for considering this request to allow me to interview you for my research titled: Ctrl-Alt-Change: Educators' Perceptions of Technology in Schools. This study will explore how and why educators are using technology in education, how and why they are not using technology in education, and their perceived best practice of incorporating technology in the classroom.

If you choose to participate, I will ask you for approximately an hour of your time to complete a spectrum activity where you indicate your perceptions regarding technology and education on a chart that I will explain to you, as well as answer some questions regarding technology and education from your point of view. I would like to interview you at your school, but out of school time so that it does not interfere with your assigned duties.

I will take great care to ensure that your privacy and confidentiality will be preserved using pseudonyms. As a voluntary participant, you may choose not to answer questions, may shut the tape recorder off at any time, and you can also opt out of the study at any time if you wish. If you choose to opt out, I will not use any of the data that you provided, and will destroy it.

Following the interview transcriptions, I will give you a copy of the data and transcripts that you provided and you will be free to change any information on it so that it reflects what you want to say. I will also provide you with a copy of the results of the study. The results of the study will be used for my thesis, and may later be published in a scholarly journal, used for a presentation or at a conference.

This study has been approved by the Behavioral Research Ethics Board at the U of S on _____, as well as our school division director.

Thanks for considering this request,

Michelle Prytula
Researcher

Letter of Consent for Participation in Research

Title of Study: Ctrl-Alt-Change: Educators' Perceptions of Technology in Schools

Supervisor: Dr. Keith Walker
Department of Educational Administration, University of Saskatchewan; ph: 966-7623
Researcher: Michelle Prytula, for M. Ed.Admin, University of Saskatchewan; ph: 242-5973

Purpose of Study: This study will explore the perceptions that educators have of issues surrounding technology in education with a focus on how technology has changed education, as well as the ideal incorporation of technology in education. Although this information is sought, it is not guaranteed.

Procedures of Study: I will ask you to complete a short charting activity using a spectrum of issues related to technology in education. I will then interview you using questions about your perceptions of technology, change, self-efficacy and teaching strategies. This interview will last approximately one hour, and will take place at your school, out of school time so that it will not conflict with your assigned duties. The interview will be tape-recorded, however, you may shut the tape recorder off, or discontinue the interview at any time during the process if you so choose.

Risks of the Study: I will transcribe and analyze the tape to discover the patterns and themes discussed, but will use pseudonyms in the transcriptions and final report to ensure anonymity. You will be given a smoothed, readable version of the transcripts on which you can add, delete or change information to reflect what you want to say. I will also ask you to sign a letter of consent for release of transcripts. I will give you a copy of the results at the end of the study.

Storage of Data: The data collected from you will be kept in a secure place at the University of Saskatchewan, Department of Educational Administration with Dr. Keith Walker for five years according to the University of Saskatchewan guidelines.

Withdrawal: You may withdraw at any time during the study without penalty or without loss of services at the University of Saskatchewan. If you withdraw, the data collected from the interview and tape recordings will be destroyed.

Dissemination of Results: The results of the study will be used for a thesis in partial completion for a Master's Degree in Educational Administration. Later, it may be published as an article in a scholarly journal or for a presentation or conference.

If you have any questions about your participation or your rights as a participant in this study, you may contact the Office of Research Services at the University of Saskatchewan (966-2084); or you can contact me, Michelle Prytula (242-5973); or my advisor, Dr. Keith Walker, Department of Educational Administration (966-7623).

I _____ *understand that this research* project has been approved by the University of Saskatchewan Advisory Committee on Ethics in Behavioral Science, on _____ *and I agree to participate. I am aware of the nature of the study and understand what is expected of me and I also understand that I am free to withdraw at any time throughout the study. A copy of this form has been given to me for my records, and at the end of the study, I will receive a copy of the report.*

_____ _____ _____

Participant Signature Date Researcher Signature

Letter of Consent for Data Transcript Release

Study Title: Ctrl-Alt-Change: Educators' Perceptions of Technology in Schools.

I am returning the transcripts of your audio-taped interviews and a copy of the spectrum activity for your perusal.

I _____, have reviewed the complete transcript and charts of my personal interview in this study, and have been provided with the opportunity to add, alter, and delete information from them as appropriate. I acknowledge that the transcript and charts accurately reflect what I said in my personal interview with Michelle Prytula. I hereby authorize the release of the transcript and charts to Michelle Prytula to be used in the manner described in the consent form. I have received a copy of this Data Transcript Release Form for my own records.

_____ _____

Participant Signature Date

_____ _____

Researcher Signature Date

Appendix B

Interview Tools

The Visual Perception Spectrum

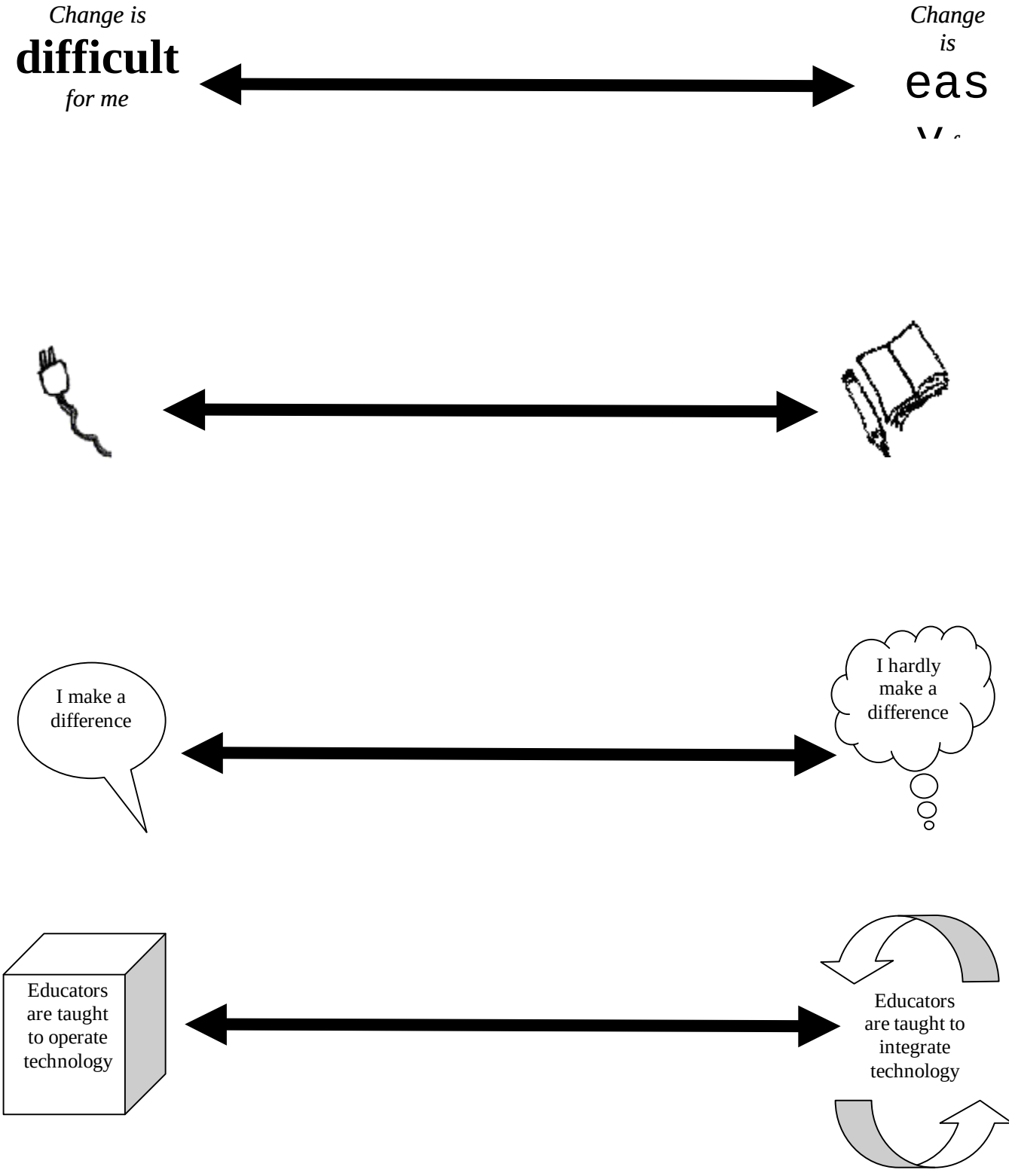
This spectrum device is a visual device incorporated in this research to provide visual sense and a starting point for each interview. The spectrum was presented to each participant at the outset of the interview, and each participant was asked to indicate, using a mark, at what place they feel they are on each spectrum. Following its completion, I was able to use the spectrum, to ask perception questions regarding why they indicated the checks at the places that they did.

The four elements of the spectrum matched components from the four schools of thought outlined in the conceptual framework. The first element of the spectrum related to how the individual perceived that they handle change on a personal level. The second spectrum related to their self-perception of being a traditional educator versus an on-line educator. The third spectrum related to their ideas of self-efficacy, and the fourth spectrum was related to their thoughts on the nature of school institutions in preparing the educator for technology in the classroom.

In constructing the spectrum, I made sure to avoid placing graphics that indicated a 'pro' technology slant all on one side, so that the research did not lean to neither technology nor tradition as the 'right' or the 'left'.

Again, these four spectrum devices provided a starting point for each interview, and provided me with a visual device which I could use in the analysis to recognize patterns and make connections between the perceptions that participants reported on the device with perceptions that they made regarding their beliefs, attitudes and self-perceptions. It was also a helpful tool, which I used to recognize unusual data and explore it further.

The Visual Perception Spectrum



Overarching Questions for Semi-Structured Interviews

1. From your perspective, in what ways has technology changed education, if any, over the past number of years?

2. What ways, if any, have you changed your teaching strategies to respond to new technology?

3. Tell me about your skills in technology, how you achieved these skills; or your sense of lacking skills and what has prevented you from obtaining these skills.

4. Tell me about your perceptions regarding how capable you feel you are to deliver technology-integrated instruction to the level that your students need.

5. In what ways do you think students become prepared for using technology beyond grade 12 – self-training, training from schools or training on the job?

6. Tell me about a time when you got or get really excited or motivated about technology in education.

7. Tell me about a time when you got or get really frustrated about technology in education.

8. As an educator, how do you feel you make a difference in the classroom?

9. Tell me about a time that you knew you made a difference in a student's life.

10. In what ways do you receive support from your school board to incorporate technology into the classroom?

11. What is your perception of the best practice of incorporating technology in the classroom?

12. Professional Information

    Years of Teaching Experience:
    Grades Taught:
    Subjects Taught:
    Technology Training:

Overarching Questions Relevance Table

Questions Related to Topic

Topic of Research

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
Response to Change	•	•	•							•	•
Beliefs of Effective Educational Practices	•	•	•	•	•	•	•	•	•		
Teacher Self-Efficacy		•	5	•		•	•	•	•		•
Conditions in Educational System	•	•			•					•	
Perceived Ideal Incorporation of Technology		•								•	•

Table 2 - Overarching Questions Relevance Table