TEACHERS AND TECHNOLOGY: A TRANSFORMATIVE JOURNEY

Thesis submitted by

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The research presented and reported in this thesis was conducted within the guidelines for research ethics outlined in the *National Statement on Ethics Conduct in Research Involving Humans (1999), the Joint NH&MRC/AVCC Statement and Guidelines on Research Practice (1997),* the *James Cook University Policy on Experimentation Ethics – Standard Practices and Guidelines (2001),* and the *James Cook University Statement and Guidelines on Research Practice (2001).*

The proposed research methodology received clearance from the James Cook University Experimentation Ethics Review Committee (Approval No. H1665).

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Abstract

Transformative learning is a process by which an adult learner critically questions previously-held beliefs, assumptions, values, and perspectives and thereby acquires a more open and better validated world view. The primary mechanism for this examination is critical reflection which results in a perspective transformation or a revision of a person's previous frame of reference. Due to its constantly-changing nature, educational technology is an ideal area in which to test the rigour of transformative learning by examining how adult learners' frames of reference change as they use, integrate, and teach technology.

The aim of this research study was to investigate the educational technology development of elementary school teachers through the lens of transformative learning theory. In particular, the research questions asked to what degree teachers experienced perspective transformations due to their development in educational technology, what external factors promoted or impeded the occurrence of perspective transformations, and whether transformative learning theory was a viable research framework to describe the teachers' development in technology.

The thesis employed a mixed-method methodology. The qualitative data were derived from reflective journal entries, a semi-structured interview, and my field notes. The quantitative data were derived from a teacher questionnaire, an administrator questionnaire, and two-tailed t-tests.

The 10 teachers did experience perspective transformations, there were distinct factors related to the perspective transformations, and transformative learning theory proved a viable theoretical framework to describe the teachers' development in technology. The four factors that promoted perspective transformations were collaboration on all levels, administrator support, time

practising ICT skills and strategies, and funding targeted in consistent ways the teachers saw as important. The three factors that impeded perspective transformations were the presence of a gauleiter (someone who is authoritative, overbearing, and megalomaniacal), an absent or weak infrastructure, and administrator pressure to engage in ICT for reasons other than the promotion of student learning. As well, the data revealed five dominant themes and 24 sub-themes related to perspective transformations. The most salient finding for transformative learning and educational technology research was the “working profile” of a transformative learner of technology. A transformative learner of technology is collaborative, open-minded and independent-minded, has a set of priorities for ICT, takes initiative, has teaching experience, is not necessarily equated to age, and possesses a predisposition for change.

The study has several implications: elements of transformative learning are suitable descriptors of technology development (theoretical), the complementarity of the data sources provided clear evidence of perspective transformations (methodological), and the professional development model used in my study ensured that teachers became engaged in, and conscious of, their own learning processes (andragogical).

The recommendations for further research include using a entire staff of teachers that would represent a cross-sample of technology experience, increasing the number of research studies that investigate not only the presence but also the degree of perspective transformation, examining whether gender is an issue in technology innovation and in technology collaboration, setting more concrete guidelines for attending workshops over a longer period of time—four to six months, revising the teacher questionnaire to clarify or exemplify each transformative learning statement, making changes to the professional development model to ascertain whether specific transformative learning elements can be maximised, and examining the potential for making the study of transformative learning theory an integral part of pre-service teacher education.

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PREFACE

To set the context for this thesis, this preface appeared to be necessary so that readers understood why I have chosen to complete another Ph. D. so soon after completing my first doctoral degree.

My first doctoral thesis topic and research were very distinct from the research contained in this thesis; however, the lessons I learned about academic writing, library and on-line researching, analysing data, and purporting a sound argument were invaluable to me. When I began a doctoral program at a North American university, I was driven to complete as quickly as possible but burned out very quickly. It was not a pleasant experience for me and I had promised myself that I would complete another Ph. D. when the timing was right. This thesis is an indication that the time was perfect to obtain another doctoral degree.

The timing became perfect to pursue a doctorate in educational technology as I was conducting research on what professional development models in educational technology were successful and felt that channelling that research into another degree would be beneficial in so many ways. I was fortunate enough to find a university that would allow me to complete the degree at a reasonable cost and to locate two extremely supportive and knowledgeable supervisors.

I never lost my passion for my first thesis topic and the research it entailed but felt let down by the university system and its bureaucracy. Gender differences in poetry imagery had fascinated me since my teaching training and then, later, as I taught teenaged students the joys of the English curriculum. My thesis involved a questionnaire to Grade 10 students followed by one-on-one sessions with 12 students. During these sessions, the students described the images evoked by two poems and their descriptions were tape-recorded. Later statistical analysis revealed several significantly-significant differences between the image-descriptions of the males and females. The findings were published in a prestigious refereed journal and I became a popular speaker to teachers and teacher-educators. Eventually these connections with teachers and schools led me to professional development in technology as so many male teachers appeared to dominate the teaching of educational technology and the female teachers seemed to be disempowered. This thesis does not investigate the gender differences as my interests became more related to adult learning principles; however, the notion of empowerment in educational technology is a constant theme in the chapters that follow.

INTRODUCTION

Setting the Context

In the last decade, two fields of educational research related to this study have surfaced. Numerous studies have investigated transformative learning, "(an) outline of a theory of adult development and a derivative concept of adult education" (Mezirow, 1978b, p. 153). Mezirow (1978a, 1978b) coined the term, "transformative learning," and promoted its use in adult education for over 25 years (Mezirow, 1981, 1989, 1990, 1991a, 1991b, 1992, 1994a, 1994b, 1995, 1996, 1997, 1998, 2000, 2003). Cranton (1994, 1996) clarified the importance of transformative learning with all adult learners and adult educators. Taylor (1997, 1998) performed a meta-analysis of research articles and doctoral dissertations to provide "a supportive, but critical picture of transformative learning theory" (p. 1). McWhinney and Markos (2003) distinguished between transformative learning and transformative education. Cranton and Roy (2003) grounded transformative learning in the concepts of individuation and authenticity; the concepts were later explored with university educators (Cranton & Carusetta, 2004).

The myriad uses of technology to support teaching and learning are evident in the professional literature of the last decade (Bitter & Pierson, 1999; Chen, 2002; Ely & Plomp, 1999; Grabe & Grabe, 2000; Heide & Henderson, 2001; Heide & Stilborne, 1999; Jonassen, 2000; Mills & Ragan, 2000; Norton & Wiburg, 1998; Roblyer, 2003a, 2003b; Schwartz & Willing, 2001; Tomei, 2002; Valmont, 2003). What is not apparent is why some teachers are integrating technology while other teachers are not. Gender, age, years of experience, and opportunity do not appear to be factors (US Department of Education, 2000).

While the application of transformative learning to efforts to help teachers understand how to use technology to support learning in their classrooms may appear to be an obvious research topic, such is not the case. In fact, few studies have examined transformative learning in the context of teachers developing an understanding of educational technology as evidenced by the fact that a recent Google search, in English, only produced the following studies: King (2001, 2002a, 2002b, 2002c, 2002d, 2002e, 2003), LaCava (2002), King's graduate student, Benson, Guy, and Tallman (2001), and Whitelaw, Sears, and Campbell (2004).

Purpose of the Study

The aim of this research study was to investigate the educational technology development of elementary school teachers through the lens of transformative learning theory.

This research study melds the two areas of transformative learning and educational technology to examine more closely what supports teachers in being more apt to deal with technology, what impedes them from doing so, and, if so, how the use, integration, or teaching of educational technology transforms teachers. By analysing the data, suggestions are made as to why technology can assist teachers beyond being an instructional tool and how technology can be better used.

Research Questions

1a. *Given professional development opportunities consistent with sound andragogy, to what degree do teachers experience a "perspective transformation" due to their development in technology?*

1b. *What factors and personal characteristics external to the professional development program appear to promote or impede their perspective transformation?*

2. *Is transformative learning a viable research framework to describe the teachers' development in technology use, integration, or teaching?*

Definitions

The following terminology is used in this doctoral thesis. Several of these terms will be re-presented in Chapter 4 as dominant themes from the data.

<u>Andragogy</u> is "the art and science of helping adults learn" (Merriam & Caffarella, 1999, p. 272) and differs markedly from assisting children's learning, or pedagogy, as it centres on self-directed learning, personal autonomy, and life experiences (Apps, 1991; Caffarella, 1994; Cranton, 1994, 1996; Galbraith, 1998; Holzberg, 1997; Kemp & Cochern, 1994; King, 2000; Lawler, 1991; Lawler, 2003; Lawler & King, 2000; Moran, 2001). Andragogy is also spelled "androgogy" in the professional literature. I have used the accepted spelling throughout this thesis to ensure consistency with the majority of research studies in adult learning.

<u>Transformative learning</u> is a learning process of examining, questioning, validating, and revising perceptions (Cranton, 1994) which is based on constructivist assumptions of adult learning. According to the most up-to-date definition, it "is learning that transforms problematic frames of reference—sets of fixed assumptions and expectations (habits of mind, meaning perspectives, mindsets)—to make them more inclusive, discriminating, open, reflective, and emotionally able to change" (Mezirow, 2003, p. 58).

<u>Perspective transformation</u> occurs when adult learners, through critical reflection, come to the realisation that new meaning structures need to be created and action

needs to be taken in order to break away from constraining psycho-cultural assumptions (Mezirow, 1981). This study follows that of Mezirow (1991a) and King (2002a) that if the learner experiences at least one of Mezirow's (1978) 11 phases of adult learning, then a perspective transformation has occurred. However, by categorising perspective transformation into distinct themes, this study furthers our understanding by not only demonstrating the occurrence of a perspective transformation but also by examining the degree of perspective transformation. Within a perspective transformation, there are distinct elements:

- Meaning scheme is "the constellation of concept, belief, judgment, and feeling which shapes a particular interpretation" (Mezirow, 1994b, p. 223). These beliefs, attitudes, and emotional reactions might change upon critical reflection by the adult learner.
- Meaning perspective is "the structure of cultural and psychological assumptions within which our past experience assimilates and transforms new experience" (Mezirow, 1985, p. 21). A meaning perspective can be epistemic (related to knowledge and how a person uses knowledge), sociolinguistic (related to language and how it is used in social settings), and psychological (related to the way learners views themselves). In short, it is a *habit of mind* which is made up of a series of meaning schemes.
- Critical reflection is questioning previously-held beliefs and assumptions, resulting in the acquisition of a new perspective based on that action.

Rationale

Traditionally, studies in transformative learning have examined various aspects of adult learning such as a clear definition of the term (Cranton, 1994; Mezirow, 2003), an application to professional development (Cranton, 1996; King, 1998; Lawler & King, 2000), minute criticisms of the original theory (Clark & Wilson, 1991; Collard & Law, 1989), a deconstruction of the concept (Cranton & Roy, 2003), and meta-analyses of empirical studies (Taylor, 1997, 2000). In other words, transformative learning was theorised as a model that was applied to how we can effectively teach adults based on what we know about how they learn best.

In the last five years, King (1999; 2001; 2002a – e; 2003) and LaCava (2002) have taken transformative learning on a different and significant avenue by applying the theory to how adults learn technology to better understand how technology could be taught to these learners. The present study will merge transformative learning and technology within the context of a small sample (10) of British Columbia elementary teachers and investigate their degrees of perspective transformation and the factors related to transformative learning.

According to Ungerleider (2003), former British Columbia Deputy Minister of Education, the promise that "with computers teaching would be transformed" (p. 118) has not been realised as the changes in teaching "have not been radical or 'transformative' as implied by the rhetoric," but are due to the fact that people will only "adapt easily to new practices that they regard as equivalent alternatives to existing practices" (p. 118). It should be noted that he does not supply any evidence for these claims but relies on his own rhetoric to prove the point. On a practical level, this study investigated the very point he attempts to make by answering the question as to whether teachers experience a perspective transformation when working with technology and what factors contribute to that transformation.

In an updated review of transformative learning theory, Taylor (2000) argued that

> it is imperative, in this new millennium, that we set a new direction of research for transformative learning theory that focuses on understanding with greater depth its inherent complexities, that engages a wider range of research designs and methodologies, and that investigates most thoroughly transformative learning as a viable model for teaching adults (p. 286).

Clearly, his meta-analyses demonstrated that there is a need for further and more varied research into transformative learning. In short, on a theoretical and applied level, this study will add to the professional literature.

Scope and Limitations of the Study

Given the fact that the sample size is small (10) and that each teacher was in the elementary level, there is no possibility for generalisability to the provincial elementary teaching population or to secondary teachers.

I attempted to spend a great deal of time, in and out of the schools, assisting each participant; however, the collection of the data was over a short period of time, four months, and therefore represented a "snapshot" of the teachers' views and experiences.

The analysis of the descriptive data was shaped by my own subjectivity (Huberman & Miles, 1998). I acknowledged that fact and attempted to ensure that the categorisation of the data was reliable through a constant comparative approach (Cresswell, 1998; Gall, Borg, & Gall, 1996; Hodson, 1991; Huberman & Miles, 1998; King 2002a, 2003; Moustakas, 1994).

No validity checks were performed on the written data immediately after I placed the comments into perspective transformation categories. However, I incorporated the feedback provided by my supervisors in relation to my categorisation of the data.

No reliability check was performed on the Learning Activities Survey – Professional Development in Technology questionnaire prior to distribution. I did, however, send the questionnaire to two researchers familiar with transformative learning and/or technology professional development in order to receive suggestions for improvement of the instrument. One person suggested no changes and the other outlined specific re-wordings of the 11 perspective transformation statements. These changes were integrated into the final version of the questionnaire.

As the teachers were asked in the interview to report their experiences with technology as they related to perspective transformation, a certain amount of reification or subjectivity may have occurred. Although I and each teacher corresponded frequently, synchronously and asynchronously, prior to the interview, no specific references to transformative learning or perspective transformation, on my part, were mentioned until the administration of the last data instrument, the semi-structured interview. In this manner, I ensured that as little contamination of the data occurred as possible. At the time of the interview, the responses to the questionnaire and the journal comments would have been completed so the interviewees would have had some sense of the purpose of the study; however, it was clear that they were not familiar with the concept or actual words of perspective transformation prior to the interview.

Each teacher and school volunteered to be part of this study and each had an obvious desire to learn more about technology. I acknowledge that the data might not be as reliable as from non-volunteers; however, the nature of the research questions necessitated motivated and interested participants rather than a random sample of teachers from the general population.

The names of the teachers were coded to ensure anonymity. Pseudonyms were not chosen so that the reader would not easily be able to identify the teachers and their respective schools. To this end, each teacher was assigned a code that designated their order of volunteering and the school in which they worked. For instance, the first volunteer from School A was coded as “A – 1” so that the reader would connect that participant’s comments with the particular school environment as school culture proved to be a significant factor in perspective transformations.

In the interest of clarity, I have used the first-person personal pronoun when referring to my research or to myself or when a participant referred to me. The use of the pronoun has been used sparingly and only when appropriate, so as to distance myself from the results.

I ensured that a defensible professional development model was used in delivering support to the 10 teachers in their technology development. However, I was aware of the Hawthorne Effect (Tashakkori & Teddlie, 2003) in that the interventions—workshops, tutorials, emails, face-to-face meetings, and telephone conversations—could promote perspective transformations. All efforts to encourage the teachers to experience perspective transformations were eschewed and support was provided only upon request.

Organisation of the Study

Besides this introduction, this thesis is organised into five chapters, appendices, and references.

This introduction presents the context, the purpose, and the rationale for the study by stressing the need for research that combines transformative learning theory with educational technology. This combination allowed me to examine the degree to which teachers experienced perspective transformations after they participated in professional development grounded in sound adult-learning principles (Research Question 1a). As well, the factors that promoted and impeded perspective transformations in the teachers are presented (Research Question 1b). Whether or not transformative learning theory is a viable research framework to investigate teachers' development in technology use, integration, and teaching is also explored in this thesis (Research Question 2). In order to better understand the elements of transformative learning, clear definitions have been provided. All research studies have restrictions, so the limitations and defined scope of my research have been outlined.

Chapter 1 reviews the professional literature on transformative learning from a variety of approaches. Mezirow's (1978a, 1978b, 1981) early development of the theory was influenced by Kuhn's (1962) paradigm, Freire's (1970) conscientization, and Habermas' (1971) domains of learning. These concepts lay the foundation for transformative learning and demonstrate that the theory is grounded in research. However, no theory is without criticism so the challenges (Clark & Wilson, 1991; Collard & Law, 1989; Tennant, 1993) and rebuttals (Mezirow, 1989, 1991b, 1994a) are presented in this chapter. A strong and enduring andragogical theory changes as more information becomes available on adult-learning principles. Mezirow's (1978a, 1978b, 1981) original theory evolved over 25 years and included an expansion of the theory to include instrumental, dialogic, and self-reflective learning (Mezirow, 1985), an additional phase, altering present relationships and forging new relationships (Mezirow, 1991a), an emphasis on critical self-reflection in perspective transformation (Mezirow, 1995), and a clear definition of his theory (Mezirow, 2003). The practical applications of transformative theory offer further evidence for its importance in adult learning and teaching (Cranton, 1994; King, 1997a) and in the professional development of adults (Apps, 1991; Caffarella, 1994; Cranton, 1996; Cranton & King, 2003; Galbraith, 1998; Kemp & Cochern, 1994; King, 2000, 2002a, 2002e; 2003; King & Lawler, 2003; Lawler, 1991, 2003; Lawler & King, 2000, 2003; Merriam & Caffarella, 1999; Taylor, Marienau, & Fiddler, 2000). The relationship between technology innovation and school change (Bates, 2000; George & Camarata, 1996; Fullan, 1999, 2001a, 2001b; Fullan & Hargreaves, 1996; Hargreaves, 2003; Means & Olson, 1995; Means, Penuel, & Padilla, 2001; Pegrum & Anderson, 1999; Sandholz, Ringstaff, & Dwyer, 1997; Schofeld & Davidson, 2002; Stuve, 1997) needs to be explored as transformation of the individual and the culture are important corollaries to perspective transformation (Mezirow, 1997, 2000). In this thesis, particular emphasis is placed on the work of King and LaCava as their research provided guidance to this study; conversely this study confirms and augments their and others' previous research (Benson, Guy, & Tallman, 2001; King, 1997b, 2000, 2003, 2004; LaCava, 2002; Whitelaw, Sears, & Campbell, 2004).

Chapter 2 outlines the research methods adopted for this study, the mixed-methodology approach (Cresswell, 1995, 2003; Reichardt & Rallis, 1994; Tashakkori & Teddlie, 1998, 2003), as it combines qualitative and quantitative research methods. The qualitative method allowed for the coding and categorisation of the rich responses from the 10 participants. The quantitative approach allowed for the inclusion of frequency counts to describe the degree of perspective transformation and the number of factors related to perspective transformations as well as to detect any statistically-significant differences between the public and independent schools. It was important to understand the backgrounds of the schools and of the 10 teachers so that a context for interpretation could be set. The data revealed that each of the three schools possessed a specific culture and regime (Hargreaves, 1994, 2003) which may or may not have promoted perspective transformations in educational technology. As well, the demographic information about each teacher is presented so that participant comments can be better understood when their backgrounds are considered. The data collection methods in this study are described to demonstrate that they are thorough, varied, confirmatory, and complementary.

Chapter 3 outlines the research findings based on the four data sources and myriad quotes from the participants. The presentation is logical as each research question is re-stated and the supporting data are outlined. The quotes exemplify each element of transformative learning. In addition, the differences among the three schools and between the school-types are highlighted with particular emphasis on the perspective transformations experienced by the individuals in the respective schools.

Chapter 4 answers the three research questions. To frame each answer within a school context, differences between and among the three schools are presented initially. Hargreaves' (2003) research on school cultures is utilised to describe the respective school environments in which the perspective transformations took place. Clearly, significant perspective transformations occurred for some teachers due to their development in educational technology but occurred minimally for others; ascertaining which factors contributed to or impeded perspective transformations was therefore critical. The data from Chapter 3 (see Tables 11, 13, and 15) were re-categorised into five themes to further report on the degree of perspective transformation experienced by the 10 participants. This degree of perspective transformation is discussed using five elements of transformative learning as key themes: (1) disorienting dilemma, (2) altered sets of meaning schemes and perspectives, (3) revised frames of reference, (4) types of learning and learning processes, and (5) critical reflection of and critical self-reflection on assumptions.

Demonstrating whether transformative learning theory is a viable research framework to describe the teachers' development in technology use, integration, or teaching is important so that other researchers can utilise this framework with assurance of maximised reliability and credibility. To this end, Chapter 4 describes the re-organisation of the data into Cranton's (1994) four stages of learner empowerment as they were robust and representative of andragogy and transformative learning: initial learner empowerment, critical self-reflection, transformative learning, and autonomy. As well, the characteristics of a transformative learner of technology are described which contributes to the literature in the three fields of transformative learning, educational technology, and adult professional development. The theoretical, methodological, and andragogical implications are outlined.

Chapter 5 presents conclusions from the thesis and provides recommendations for further research. The research proved that the teachers experienced, through critical reflection of assumptions and critical self-reflection on assumptions, varied, and varying alterations in their, meaning schemes, meaning perspectives, and frames of reference due to their technology development (Research Question 1a). It also demonstrated that there are specific external factors related to perspective transformations that promote or impede perspective transformations due to teachers' use, integration, and teaching of educational technology (Research Question 1b). A further conclusion was that transformative learning theory is clearly a defensible research framework to describe teachers' development in educational technology (Research Question 2). The theory is extremely complex and involves many inter-related facets of transformation that would prove useful in articulating how teachers develop as they use, integrate, and teach educational technology. The chapter concludes with seven recommendations for further research and highlights the significant contributions that this study offers.

The appendices provide the adapted Learning Activities Survey – Professional Development in Technology teacher questionnaire (Appendix A), the informed consent form (Appendix B), the administrator questionnaires from each school (Appendices C, D, and E), one respondent's professional development action plan (Appendix F), an example schedule of interview questions (Appendix G), a sample transcribed interview (Appendix H), two sample field note entries (Appendix I), an example of an email exchange (Appendix J), and a sample planning diagram (Appendix K).

CHAPTER 1

LITERATURE REVIEW

Transformative learning theory is “a deep, structural shift in basic premises of thought, feelings, and actions” (Transformative Learning Centre, 2004). However, this definition belies the fact that the theory is complex and multifaceted.

The structure of this chapter is divided into five sections. The first section commences with a discussion of transformative learning. Specifically, a review of the professional literature related to its inception (Mezirow, 1978a, 1978b), critiques (Clark & Wilson, 1991; Collard & Law, 1989; Mezirow, 1989, 1991a), revisions (Mezirow, 1985, 1991b, 1995, 2000), and practical applications (Cranton, 1994; King, 1997a, 1999) is presented here. As this study investigates the experiences of teachers as they use, integrate, and teach technology, the second section is a review of the principles of adult learning. The third section outlines the professional development of adults (e.g., Apps, 1991; Cranton, 1994, 1996; King 2002a; Lawler & King, 2000, 2003; Merriam & Caffarella, 1999) to provide the basis for a defensible professional development model to assist teachers experience perspective transformations. The fourth section contains a review of the professional literature within the context of technology innovation and school change (Bates, 2000; George & Camarata, 1996; Fullan, 1999, 2001a, 2001b; Fullan & Hargreaves, 1996; Hargreaves, 2003; Means & Olson, 1995; Means, Penuel, & Padilla, 2001; Pegrum & Anderson, 1999; Sandholz, Ringstaff, & Dwyer, 1997; Schofeld & Davidson, 2002; Stuve, 1997). This contextualisation helps demonstrate the worth of transformative learning as a stand-alone theory or in conjunction with the school ICT diffusion models. The last chapter section presents an in-depth critique of the dearth of studies dealing with transformative learning and educational technology (Benson, Guy, & Tallman, 2001; King, 1999, 2001, 2002a, 2002e, 2003; LaCava, 2002; Whitelaw, Sears, & Campbell, 2004).

Transformative learning theory

Early development

Mezirow (1978a) first applied the label "transformation" in his study of American women returning to post-secondary study or the workplace after an extended time out. In an effort to address the needs of American women who were resuming their education or were considering employment after an extended period of time out of university or the workforce, respectively, Mezirow (1978a) conducted a qualitative study to "identify factors that characteristically impede or facilitate" (p. 6) women's progress in the re-entry programs. In the original 1975 study, Mezirow (1978a, 1978b) investigated 12 re-entry college programs with 83 women. The 12 programs represented a diversified population from New York-New Jersey (5 programs), San Francisco (5 programs), and Washington state (2 programs). As well, the women were participating in programs from four, two-year colleges and were divided into four distinct groups: re-entry into university after a long absence (51 women), college women's centre for counselling (8 women), regular adult enrolling, first-semester community college students (16 women), and a program to assist working women to manage their careers (14 women). As a follow-up to the study, he conducted a nationwide telephone survey of 24 on-site programs in 11 states. In addition, he sent a mail enquiry to 1,172 two-year colleges and received responses from 846 colleges of which 314 sponsored re-entry programs for women (Mezirow, 1978a). Mezirow (1978a, 1978b) and his team of researchers analysed all the data and concluded that the subjects experienced a "personal transformation" and identified 10 phases that respondents could experience (see Table 1).

Table 1: *Mezirow's (1978a, 1978b)* 10 *phases of transformative learning*

Phase 1	A disorienting dilemma
Phase 2	A self-examination with feelings of guilt or shame
Phase 3	A critical assessment of epistemic, sociocultural, or psychic assumptions
Phase 4	Recognition that one's discontent and the process of transformation are shared and that others have negotiated a similar change
Phase 5	Exploration of options for new roles, relationships, and actions
Phase 6	Planning of a course of action
Phase 7	Acquisition of knowledge and skills for implementing one's plans
Phase 8	Provisional trying of new roles
Phase 9	Building of competence and self-confidence in new roles and relationships
Phase 10	A reintegration into one's life on the basis of conditions dictated by one's perspective

The two over-riding themes of these phases could be characterized as the disorienting dilemma (Phase 1) and critical self-reflection (Phases 2 to 10) (Mezirow, 1991a). The former

> begins when we encounter experiences, often in an emotionally charged situation, that fail to fit our expectations and consequently lack meaning for us, or we encounter an anomaly that cannot be given coherence either by learning within existing schemes or by [rote] learning new schemes (Mezirow, 1991a, p. 94).

The second theme, critical self-reflection, involves an examination of the factors (Phases 2 – 10) which cause a change in a person's worldview. It is important that the person consider these contributing factors to the change so that a demonstrable transformation can occur in that phase (Mezirow, 1991a).

The influences on Mezirow's early theory of transformative learning included Kuhn's (1962) "paradigm," Freire's (1970) "conscientization," and Habermas' (1971, 1984) domains of learning (Mezirow, 1978a, 1991a, 2000). The key ideas of these theorists informed Mezirow's transformative learning theory and the significant concepts of disorienting dilemma, meaning schemes, meaning perspectives, perspective transformation, frame of reference, levels of learning processes, habits of mind, and critical self-reflection. Table 2 outlines these early influences on specific facets of transformative learning theory.

Table 2: *The influences on Mezirow's early transformative learning theory and its related facets*

Influence	Transformative learning facet
Kuhn's (1962) paradigm	Perspective transformation
	Frame of reference
	Meaning perspective
	Habit of mind
Freire's (1970) conscientization	Disorienting dilemma
	Critical self-reflection
	Habit of mind
Habermas' (1971; 1984) domains of learning	Learning processes
	Perspective transformation
	Meaning scheme
	Meaning perspective

Kuhn’s (1962) conception of “paradigms” provided a basis for Mezirow’s notion of transformative learning. During a one-year period at the Center for Advanced Studies in the Behavioral Sciences, Kuhn (1962) wrote an essay on the history and nature of science. In the process of writing the essay, he realised that there was a major disagreement between the social scientists and the natural scientists as to what constituted legitimate scientific inquiry. In investigating the source of the disagreement, Kuhn (1962) theorised the importance of “paradigms” which he defined as “universally recognized scientific achievements that for a time provide model problems and solutions to a community of practitioners” (p. viii), which in Mezirow’s (1985, 1991, 2000) theory, became the frame of reference (see Table 2). Furthermore, paradigms shared two essential elements: a scientific discovery that was clearly unprecedented enough to attract a group of researchers away from other interests (i.e., a set of meaning schemes) and an open-endedness that would leave problems to be solved or redefined by the scientists (i.e., a meaning perspective) (see Table 2). Kuhn (1962) provided several examples of paradigms throughout history but argued that the history of electrical research in the first half of the eighteenth century exemplified best the nature of a paradigm.

According to Kuhn (1962), there were numerous and conflicting views on the nature of electricity and all were derived from the theories of the day; however, despite having read each other’s work, there was no discernible commonality across the various views, or a shared frame of reference (Mezirow, 1991). Benjamin Franklin and his successors evolved a theory that combined many aspects of the conflicting theories and answered several of the unanswered questions which attracted a group of “electricians” who continued Franklin’s pioneering work. This community of practitioners also demonstrated why some theories or views do not become paradigms because, “in the absence of a paradigm or some candidate for a paradigm, all of the facts that could possibly pertain to the development of a given science are likely to seem equally relevant” (Kuhn, 1962, p. 15). In short, a paradigm for electricity was formed through the combined efforts of these scientists because they shared a common set of problems and solutions (i.e., habits of mind) and yet were able to pursue their own interests (i.e., meaning perspectives) within that paradigm and came to share a common worldview (i.e., perspective transformation) (see Table 2).

As transformative learning involves a frame of reference comprised of habits of mind and meaning perspectives which led to a perspective transformation, the influence of Kuhn’s (1962) paradigm is quite apparent in Mezirow’s (1978, 1981, 1985, 1991, 2000) work (see Table 2). In addition, the theory of transformative learning, itself, has become a paradigm as it has explained many of the unanswered questions about adult learning, has created its own group of specialised practitioners, and has spawned an international journal (*The Journal of Transformative Education*) dedicated to the original theory and its revisions.

Like Kuhn’s (1962) paradigm, the work of Paulo Freire also informed Mezirow’s initial theories. Freire (1970) likened traditional education to the “banking” method of learning whereby the teacher deposits information to those students whom the teacher deems worthy of receiving the gift of knowledge. The major problem with this form of education is that students become dependent on the teacher for knowledge and do not learn to think for themselves: “The more students work at storing the deposits entrusted to them, the less they develop the critical consciousness which would result from their intervention in the world as transformers of that world” (Freire, 1970, p. 60). Freire’s antidote to this reliance on someone else and the lack of free thought was “conscientization” and its emphasis on developing a consciousness that has the power to transform reality (Freire, 1970). He defined "conscientization" as "learning to perceive social, political, and economic contradictions—developing a critical awareness—so that individuals can take action against the oppressive elements of reality (Freire, 1970, p. 19). Freire (1970) argued that for education to be empowering, the teacher needs to be not only democratic but also form a transformative relationship between the teacher and the students, students and their learning, and students and society. To Freire, education does not stop in the classroom but continues in all aspects of a learner's life. Therefore, education is always political in nature—-regardless of whether the learner and teacher realise their politics (Shor & Freire, 1987). For instance, politics influences the way the teacher discusses concepts with students, the types of tests used, the activities and materials chosen for study, and the level of risk taking in the classroom (Shor, 1993).

Freire (1973) further argued that teachers themselves have a difficult time getting past the "instilled certainty" (p. 52) that teaching is lecturing and that knowledge is uni-directional. Before the classroom can be democratic, the teacher has to welcome input from the students as well as present critical ideas for discussion so that they "affirm themselves without thereby disaffirming their students" (Freire & Faundez, 1989, p. 34). The conduit for this democracy is conscientization and its related critical consciousness which Freire argues is actualised through three stages of consciousness growth (Freire, 1973).

The lowest stage of consciousness growth, "intransitive thought," occurs when people feel that their lives are out of their control and that change is up to fate or God. They fatalistically believe that their actions cannot change their conditions and feel disempowered with little hope for the future. The next stage, "semi-transitive," involves some thought and action for change but an individual at this stage addresses problems one at a time and as they occur rather than seeing the problem as one of society, in general. At this stage, individuals may follow a strong leader who is seen as one who can change one's lot in life rather than become a leader or see oneself as a change agent. The highest level of "critical transitivity" is reflected in individuals who think globally and critically about their present conditions and who decide to take action for change. These people are able to merge critical thought with critical action in order to effect change in their lives and to see what the catalyst for that change could be. It is this last stage of critical consciousness that clearly influenced Mezirow in his notions of disorienting dilemma and critical self-reflection (Mezirow, 1978a, 1978b, 1985) (see Table 2).

Habermas (1971) also influenced Mezirow's theory of transformative learning. From 1956 to 1959, Habermas studied at the Frankfurt Institute for Social Research as an assistant to Theodor Adorno, who had been instrumental in Habermas' formulation of his early ideas of social reform (Morrow & Torres, 2002). The Frankfurt Institute was originally grounded in Marxism but abandoned that focus when the founder, Max Horkheimer, repudiated his former Marxist ideology in favour of more right-wing ideologies. In fact, Horkheimer became threatened by Habermas and Habermas' argument to return to Marxist roots, and attempted to have Habermas disassociated from the Frankfurt School. In 1961, Habermas accepted a professorship at Heidelberg University and produced his seminal work that critiqued modern democracy (Habermas, 1989). Three years later, he returned to the University of Frankfurt as a chair of philosophy and subsequently became involved in the emerging student political movement. He soon became isolated from the movement and eventually rejected Marxism in favour of his theory of communicative action (Habermas, 1984) which was articulated during his directorship of the Max Planck

Institute. It was in this two-volume work that Habermas (1984) stressed the importance of people communicating with each other in an effort to come to a common understanding so that it was not

> the relation of a solitary subject to something in the objective world that can be represented or manipulated, but the intersubjective relation that speaking and acting subjects take up when they come to an understanding with one another about something (p. 392).

The theory was revised over the next 20 years. However, it was primarily Habermas' (1971) early work on domains of learning that was influential on Mezirow's transformative learning theory (see Table 2).

In 1981, Mezirow turned to the work of Habermas to devise a critical theory of adult learning and adult education. Habermas (1971) purported three domains of learning: (1) the technical, (2) the practical, and (3) the emancipatory. Technical learning is that learning that is rote, specific to a task, and clearly governed by rules; in the case of my study, teachers who learn the requisite parts of a webpage would be engaging in technical learning. Practical learning involves social norms; teachers who understand how to interact in an on-line chat room would be experiencing practical learning. Emancipatory learning is introspective as the learner is self-reflective and experiences self-knowledge; teachers who alter a technology lesson based on critical self-reflection that their previous teaching was ineffective to achieve the intended student learning outcomes, would be encountering emancipatory learning. Mezirow's examination of these three domains led to his description of perspective transformation as

> the emancipatory process of becoming critically aware of how and why the structure of psycho-cultural assumptions has come to constrain the way we see

> ourselves and our relationships, reconstituting this structure to permit a more inclusive and discriminating integration of experience and acting upon these new understandings (Mezirow, 1981, p. 6).

In other words, the perspective transformation encompassed the aforementioned 10 phases of adult learning (see Table 1).

Based on his pioneering research with adult learners, Mezirow (1978a) outlined "a theory of adult development and a derivative concept of adult education" (p. 153) that has been argued for and against for over 20 years (Cranton, 1994). Several years after his initial theory was proposed, Mezirow (1991a) revised the original 10 phases that adults go through when experiencing a *perspective*, rather than a personal, *transformation* and added an eleventh stage, altering present relationships and forging new relationships, to the theory. Table 3 outlines Mezirow's changes in transformative learning theory over the last 30 years.

Table 3: *A summary of Mezirow's transformative learning theory by year and salient element*

Year	Salient element
1978	• Proposed initial 10 phases of theory (see Table 1)
1981	• Adapted Habermas' (1971) three domains of learning: technical, practical, and emancipatory (see Table 2)
1985	• Expanded theory to include instrumental, dialogic, and self-reflective learning • Defined meaning scheme and meaning perspective • Introduced three learning processes: learning within meaning schemes, learning new meaning schemes, and learning through meaning transformation
1991	• Added an additional phase, stressing the importance of altering present relationships and forging new relationships • Expanded earlier notion of the distorted meaning perspective • Argued that there were three types of meaning perspectives: epistemic, sociolinguistic, and psychological

1995	• Presented three types of reflection: content, process, and premise • Stressed the importance of critical self-reflection in perspective transformation
1998	• Articulated critical reflection of assumptions which included objective and subjective reframing
2000	• Presented last revision of transformative learning
2003	• Provided clear definition of his theory

Mezirow's (1978a, 1978b) initial theory became more developed as he expanded the view of perspective transformation by relating the emancipatory process to self-directed learning in order to form three revised types of learning. The original three types of learning (technical, practical, and emancipatory), based on Habermas' (1971) work, became (1) instrumental, (2) dialogic, and (3) self-reflective (Mezirow, 1985). Simply stated, learners ask how they could best learn the information (instrumental), when and where this learning could best take place (dialogic), and why they are learning the information (self-reflective) (see Figure 1). Central to the perspective transformation, and therefore the three types of learning, are the meaning perspective and the meaning schemes.

A meaning perspective refers "to the structure of cultural and psychological assumptions within which our past experience assimilates and transforms new experience" (Mezirow, 1985, p. 21) whereas a meaning scheme is "the constellation of concept, belief, judgment, and feeling which shapes a particular interpretation" (Mezirow, 1994b, p. 223). For instance, teachers may believe that they are expected by their school district or administrator to integrate technology based on their past experiences of curriculum implementation (meaning perspective) but do not believe that they have the competence to do so when a specific situation arises in the classroom or computer lab based on their past experiences with

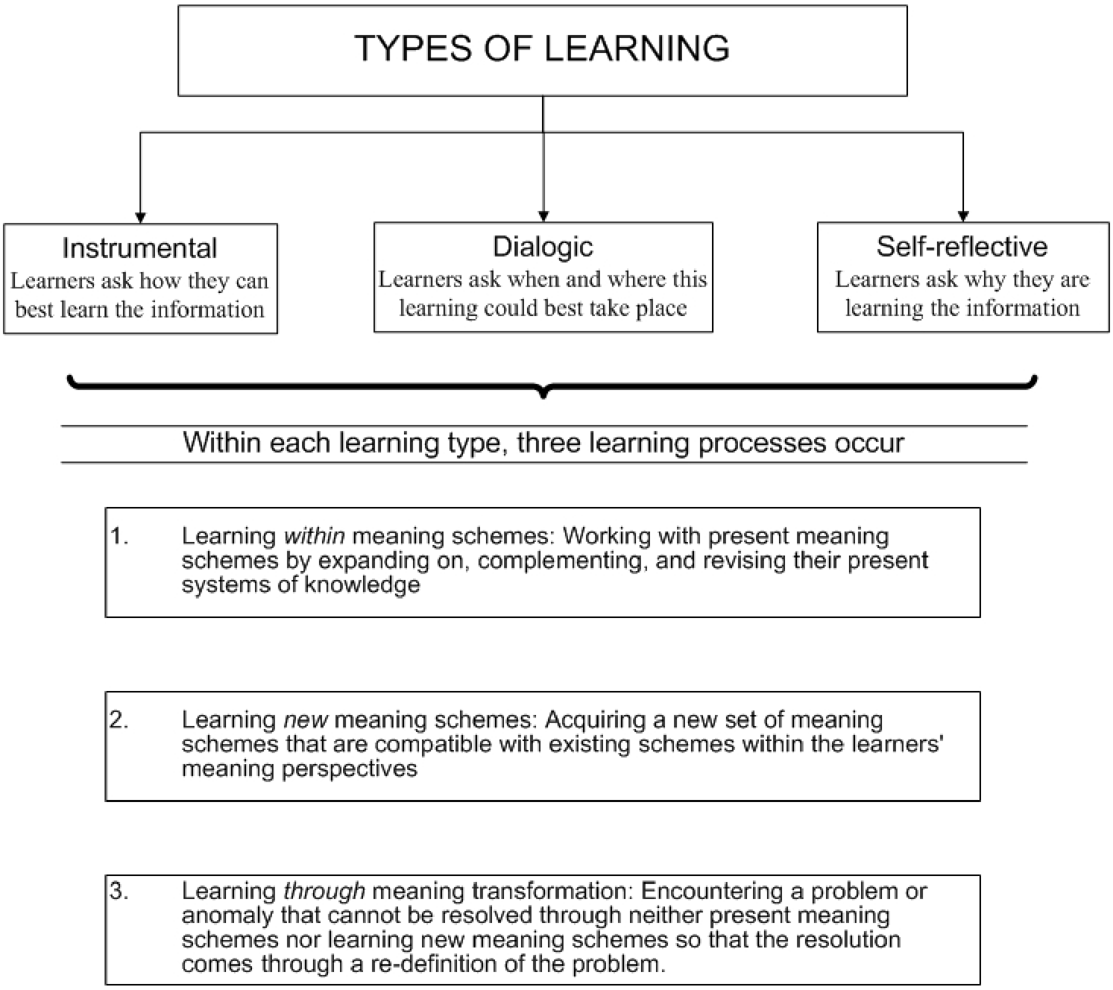


Figure 1. Diagrammatic representation of Mezirow's (1985) revised transformative learning theory

technology (meaning scheme). In short, a meaning perspective is a general frame of reference comprising a series of specific meaning schemes.

Within each of the three learning types, three learning processes operated: learning *within* meaning schemes, learning *new* meaning schemes, and learning *through* meaning transformation.

The first learning process, learning within meaning schemes, involves learners working with what they already know by expanding on, complementing, and revising their present systems of knowledge. The example of teaching in a computer lab can elucidate this first learning process within the three learning types. *Instrumentally*, teachers can review the most efficient manner to manage a large group of students in a computer lab. *Dialogically*, they may be inclined to question the best method of teaching a technological concept (e.g., hyperlinks), based on what they believe as well as on what their colleagues have discussed. *Self-reflectively,* teachers may record their observations of what appears to work best with the students and use that information to plan the next class or classes.

The second learning process within each of the three learning types is learning *new* meaning schemes that are compatible with existing schemes within the learners' meaning perspectives. Instrumentally, teachers can attempt to create webpages without relying on any notes whereas previously they relied on tutorials and handouts for guidance. Dialogically, they can acquire a new constructivist theory of web-learning (e.g., WebQuests) to augment their previous knowledge (e.g., webpage construction). Self-reflectively, they can view themselves as technology specialists when they previously saw themselves as competent and confident but not specialised.

The last learning process within each of the three learning types is learning *through* meaning transformation. This process requires "becoming aware of specific assumptions (schemata, criteria, rules, or repressions) on which a distorted or incomplete meaning scheme is based and, through a reorganization of meaning, transforming it" (Mezirow, 1985, p. 23). In short, the learner encounters a problem or anomaly that cannot be resolved through present meaning schemes or through learning new meaning schemes; the resolution comes through a re-definition of the problem. Transformation occurs by critical self-reflection of the assumptions that supported the meaning scheme or perspective in use. Through instrumental learning, the teacher understands that re-arranging the physical layout of a computer lab could result in increasing efficiency in moving around the lab to assist students. Through dialogic learning, the teacher comes to the conclusion that gender and age are not inhibitors for learning how to operate a computer. Through self-reflective learning, the teacher, who felt anxiety based on past failures with technology, becomes confident and competent in digital video editing. It should be stressed it is only this last process, learning through meaning transformation, that results in perspective transformation.

Perspective transformation can occur in two dimensions. Each dimension is related to changing meaning schemes.

On the one hand, it can occur painlessly through an accumulation or concatenation of transformations in set meaning schemes (Mezirow, 1985). Thus, a teacher may experience a perspective transformation through a series of altered meaning schemes or “the constellation of concept, belief, judgment, and feeling which shapes a particular interpretation” (Mezirow, 1994b, p. 223). For example, teachers can examine how they learned to use keyboard shortcuts in Microsoft Word and realise that those same techniques are useful in related Microsoft products.

On the other hand, perspective transformation may also be an “epochal …[and] … painful” (Mezirow, 1985, p. 24) transformation of meaning perspectives, or sets of meaning schemes, as this dimension involves a comprehensive and critical re-evaluation of oneself. For example, teachers can critically examine their philosophy of technology and its role in primary school classrooms and come to the realisation that what they believed previously no longer holds true for them (i.e., self-reflective learning within meaning schemes).

Mezirow (1991a, 1994b) argued that the central element to the perspective transformation is critical self-reflection. In other words, if a learner rationalised a new point of view without dealing with the deep feelings that accompanied the original meaning scheme or perspective, perspective transformation could not occur. Similarly, if a teacher adopted a new belief system through a top-down, power-coercion paradigm (Hord, 1992), perspective transformation would invariably be aborted (Mezirow, 1994b). In other words, if teachers did not reconcile the deep feelings or had points of view subjected on them, they would learn without questioning the veracity or utility of the information.

This critical self-reflection of deep-seated feelings demonstrates that perspective transformation is compatible with the field of educational technology due to the rapid rate of change involved with educational technology, the anxiety and trepidation experienced by teachers, and the incredible amount of misinformation available on the Internet. Critical self-reflection played an important part in the perspective transformations of the 10 participants in my study.

Criticisms

Four years after Mezirow's (1985) initial theory of transformative learning, Collard and Law (1989) levied the first critique of transformative learning. They argued that Mezirow (1981) had underemphasized the importance of collective social action which they perceived as the requisite goal of transformative learning and he had failed "adequately to address questions of context, ideology and radical needs embodied in popular struggles" (p. 100). Their criticism was clearly flawed as there is not an unhindered linear relationship between transformative learning and collective social action. Perspective transformation can be collectively socio-cultural, to be sure. Transformative learning can also be an individual's social action (e.g., transforming students ICT learning to affect positive job opportunities on exit from school). However, transformative learning activities can lead to a person realising that there are multiple solutions to a problem (epistemic) or they can draw out, through critical self-reflection, latent memories of past learning experiences (psychological) (Mezirow, 1989). Transformative learning clearly involves action; however, not always is the action collectively social in nature. Any action that resides with the learner (Mezirow, 1989) as transformative learning "is profoundly intersubjective, but is not exclusively group mediated" (p. 173). In other words, transformative learning activities can cause collective social action, such as delineated in Mezirow's (1978a, 1978b) original research which clearly demonstrated the empowerment of women and the subsequent influential collective support of women's re-entry into college programs.

Little criticism of transformative learning surfaced in the literature after Collard and Law's (1989) article (Cranton, 1994); the few studies that did present a critique, Clark and Wilson (1991) and Tennant (1993) were addressed by Mezirow (1991b, 1994a). No further criticisms were noted in the professional literature after Tennant's (1993) article.

Mezirow presented a sound defence to Clark and Wilson's (1991) concern that he (Mezirow, 1978a, 1978b) did not account for the cultural context of learning and was limited to white, male middle-class values. He stated that the study was his own "historic insensitivity to the cultural context [rather than a] challenge to the findings regarding perspective transformation" (p. 192). He further suggested that Clark and Wilson (1991) had misinterpreted his argument but also admitted that this misinterpretation may have been because he had not communicated his ideas effectively. More specifically, Clark and Wilson had misinterpreted Mezirow's (1985) emphasis on the individual and on self direction and autonomy to the exclusion of collaborative social action which Mezirow had not purported (Mezirow, 1991b). Mezirow (1991b) argued that the two authors further misinterpreted his ideal conditions for rational discourse and stressed that he had "attempted to show that every belief or perspective … is not equally functional for interpreting experience" (p. 190). For example, when learners engage in rational discourse, they learn to accept certain beliefs (i.e., meaning schemes) and perspectives (i.e., meaning perspectives) and to reject others that serve little or no purpose for the learner's interpretation of that discourse experience. The learners engage in the process of validating what they have already learned or culturally assimilated by other learners, who are part of the social culture, in critical discourse. Mezirow (1991a) also asserted that he had "moved to a higher level of abstraction, not one which somehow seeks to transcend culture, but which identifies the essence of how our culture prescribes this process of learning" (p. 191). In other words, Mezirow (1991a) saw critical self-reflection and rational discourse as by-products of the culture, not outside of the culture.

Tennant's (1993) main argument was that "what is, and is not, more integrative of experience depends on the social and historical context in which experience occurs" (p. 37). Mezirow (1994a) agreed with Tennant (1993) but cogently pointed out that not every perspective transformation had to "involve a critique of social oppression" (p. 243) as Tennant's (1993) work also appeared to imply. In other words, perspective transformations are both individualistic and framed by social and historical contexts. Thus a learner might address social criticism when the opportunity for critical discourse presents itself; other times, the learner might choose to discuss other influences such as psychological, sociolinguistic, or epistemic codes (Mezirow, 1994a).

Revision of the theory

In 1991, Mezirow (1991a) expanded the original 10-phase model of perspective transformation to include an additional phase, “Renegotiating relationships and negotiating new relationships” (Mezirow, 1994b, p. 224), between the original phases 8 and 9. This new phase reflected the importance of critical self-reflection. He further outlined the constructivist assumptions that formed the basis of the revised theory as including “a conviction that meaning exists within ourselves rather than in external forms such as books and that personal meanings that we attribute to our experience are acquired and validated through human interaction and communication” (Mezirow, 1991a, p. xiv). In other words, meaning is individualistic and found inside the learner and teacher rather than prescribed by external influences such as written texts and speeches; however, that meaning becomes significant to the learner through critical discourse with others. This view is reminiscent of Kuhn’s (1962) paradigm and Freire’s (1970) conscientization as well as of the constructivists (Kelly, 1970; Knowles, 1975; Kolb, 1984; Piaget, 1972) and social constructivists (e.g., Vygotsky, 1978).

Mezirow (1991a) elaborated his earlier notion of the distorted or undeveloped meaning perspective (Mezirow, 1985) that leads the learner “to view reality in a way that arbitrarily limits what is included, impedes differentiation, lacks permeability or openness to other ways of seeing, [and] does not facilitate an integration of experience” (Mezirow, 1991a, p. 188). He now contended that there are, in fact, three types of meaning perspectives: epistemic (related to knowledge and how a person uses knowledge), sociolinguistic (related to language and how it is used in social settings), and psychological (related to the way people viewed themselves). The remedy for any epistemic, sociolinguistic, and psychological distortions is the perspective transformation through the revised 11-phase model and accompanying reflective discourse. In other words, when a person begins to interpret new meaning perspectives and meaning schemes, discussion with peers provides an ideal vehicle for learning in a school. However, it is not necessary that a person experience all 11 phases or in a set order to experience a perspective transformation.

According to Mezirow (1991a), under optimal conditions, participation in this discourse would have

> accurate and complete information, be free from coercion and distorting self-perception, be able to weigh evidence and assess arguments objectively, be open to alternative perspectives, be able to reflect critically on presuppositions and their consequences, have equal opportunity to participate (including the chance to challenge, question, refute, and reflect, and to hear others do the same), and be able to accept an informed, objective, and rational consensus as a legitimate test of validity (p. 78).

The application of distortions in epistemic, sociolinguistic, and psychological meaning perspectives and the use of critical discourse with others are clearly applicable to learning educational technology. Teachers would need to re-evaluate what they believed they knew and what they actually knew (epistemic), what specific language was used in educational technology settings (sociolinguistic), and what they perceived about their own ways of learning (psychological) through critical discourse with other learners or mentors.

In a book chapter on adult learning theory, Mezirow (1995) emphasised the importance of critical reflection in transformative learning theory. Straightforward reflection is the act of “intentional assessment” (p. 44) of one’s actions whereas critical reflection not only involves the nature and consequence of one’s actions but also includes the related circumstances of their origin. He presented three types of reflection and their roles in transforming meaning schemes and perspectives: content reflection, process reflection, and premise reflection. In the process of reflection, teachers ask themselves critical questions (Cranton, 1994). Figure 2 illustrates the relationship among these types of reflection.

Content reflection involves thinking back to what was done and therefore might involve a transformation of a meaning scheme (see Figure 2). For example,

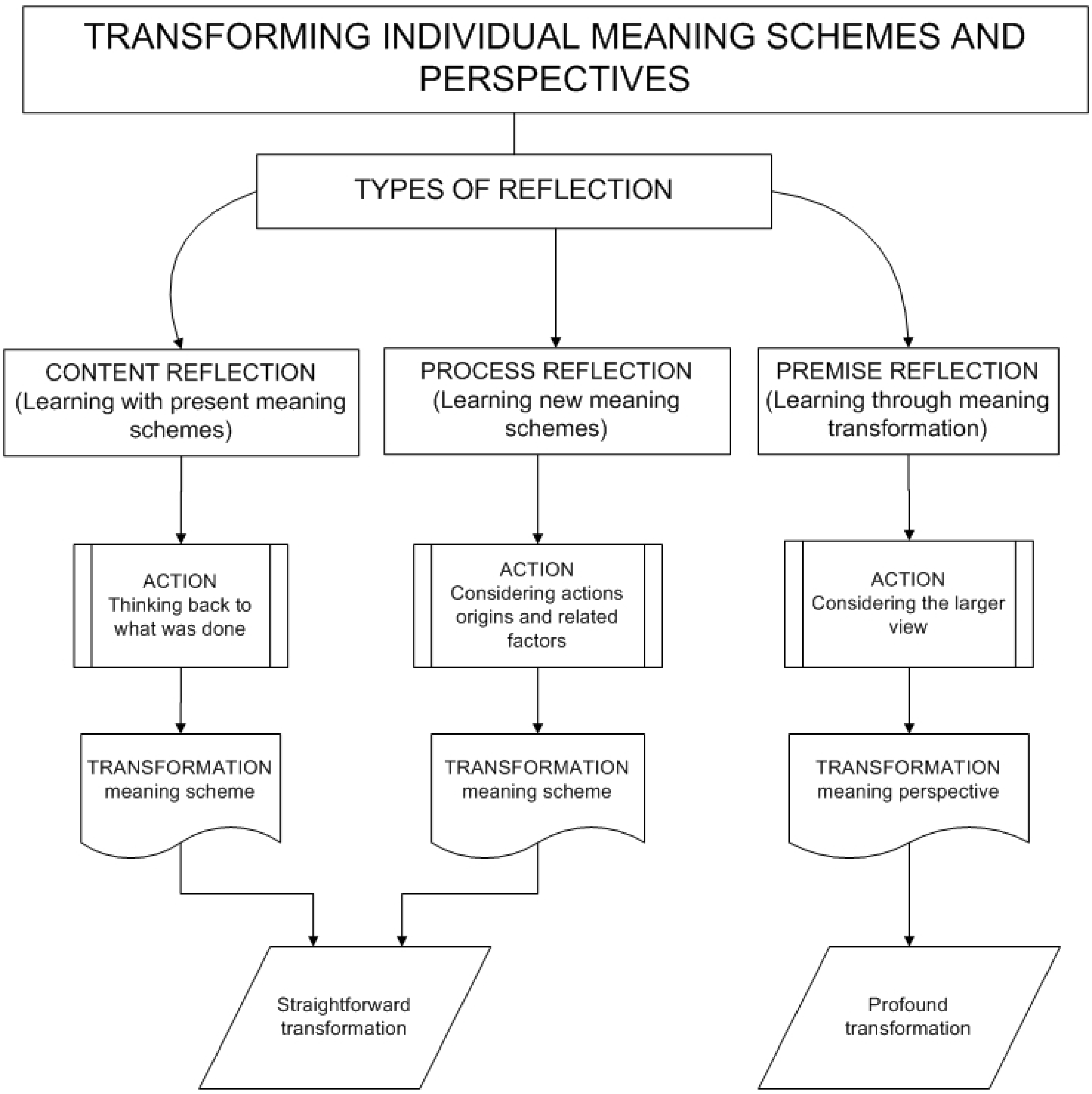


Figure 2. Diagrammatic representation of the three types of reflection, their related actions, transformations, and depths of change (Mezirow, 1995)

a teacher might ask: “What do I believe I can do with PowerPoint in my Grade Six class, given my knowledge and past experiences?” Process reflection causes a person to consider the aetiology of actions and whether there are other factors yet to be unveiled; this form of reflection might also transform meaning schemes (see Figure 2). For instance, a teacher might ask: “What were the positive and negative factors when students created PowerPoint projects that will assist me in planning the lessons for this new program?”. Premise reflection requires the person to see the larger view of what is operating within that person’s value system, for instance, and could transform a meaning perspective rather than a meaning scheme (see Figure 2), the latter of which is “the constellation of concept, belief, judgment, and feeling which shapes a particular interpretation” (Mezirow, 1994b, p. 223). For example, the teacher might ask: “Why is using PowerPoint so important to me at this time in my career when I could use the same strategies I have used for twenty years?”. Thus, critical reflection is the process of premise reflecting (see Figure 2).

In other words, learners can transform an individual meaning scheme by examining previous actions (content reflection or learning *within* meaning schemes) or where the actions and their related factors originated (process reflection or learning *new* meaning schemes) but when they consider a more global view, the reflection is much deeper, more complex, and involves transforming a series of meaning schemes (premise reflection or learning *through* meaning transformation; see Figure 2). In short, there are two types of transformation: straightforward transformation of a meaning scheme which occurs through content and process reflection, and a much more profound transformation of a set of meaning schemes (i.e., meaning perspective) by critically premise reflecting (see Figure 2).

Based on further research, Mezirow (1998) refined his earlier work on critical reflection (Mezirow, 1995). He presented two new aspects of critical reflection. One of these aspects was the critical reflection of assumptions which is the idea of not only looking back on something that occurred but also examining the assumptions or presuppositions that were involved in the reflection process (i.e., content and process reflection) (see Figure 3). The other new aspect was the related concept of critical self-reflection of assumptions. It involves "a critique of a premise upon which the learner has defined a problem" (Mezirow, 1998, p. 186). Therefore, critical self-

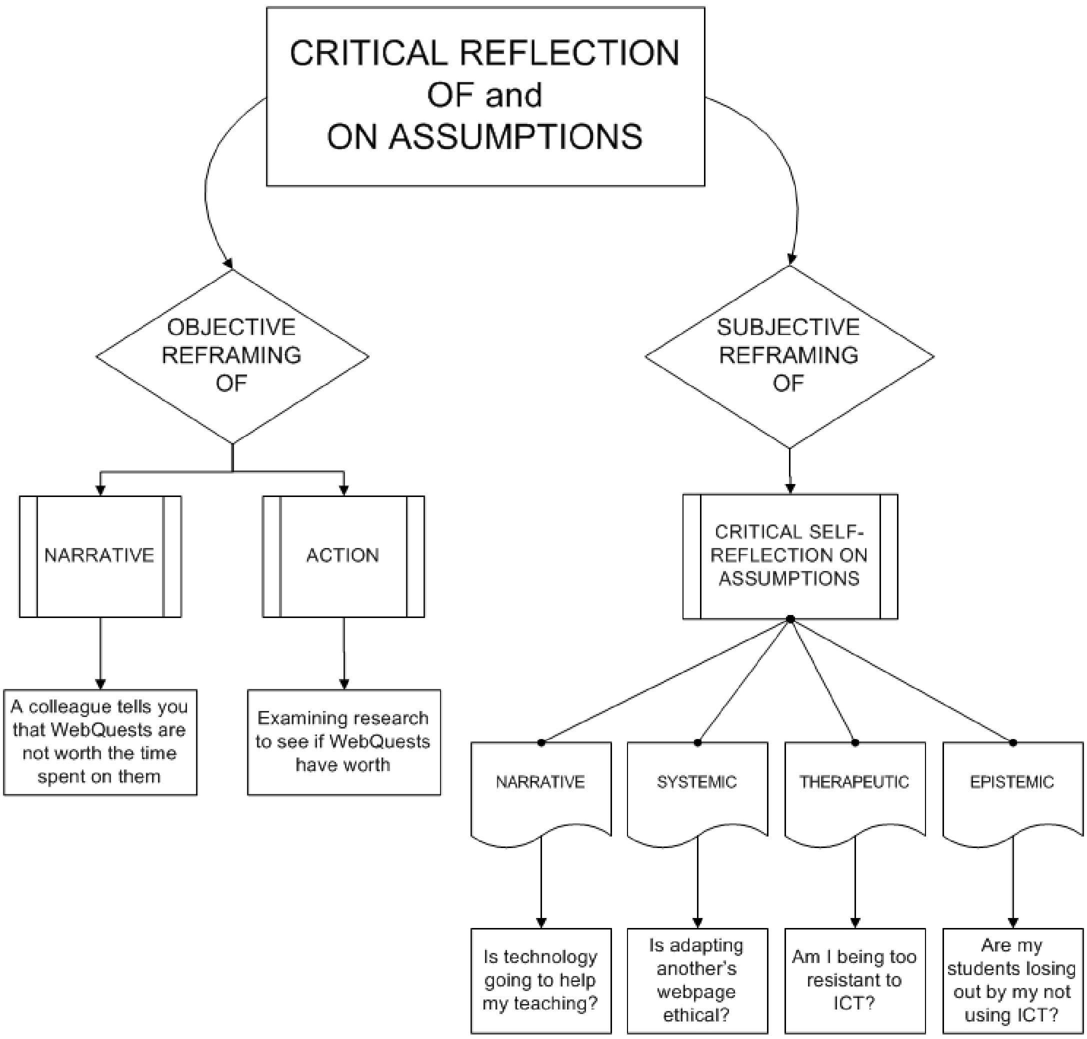


Figure 3. Diagrammatic representation of Mezirow's (1998) taxonomy of critical reflection of and on assumptions

reflection of an assumption is akin to premise reflection (Mezirow, 1995). For instance, learners examine their worldview in light of their own particular belief or value system, such as a teacher who believes that only younger colleagues can learn about computers and resists attending educational technology workshops. Citing King and Kitchener's (1994) seven stages of adult learning development, Mezirow (1998) argued that their stages six, "abstract concepts of knowledge [that could] be related," and seven, "abstract concepts of knowledge [that] are understood as a system" (p. 208), respectively, together were what he was describing as critical self-reflection of assumptions.

He went on to articulate a taxonomy of critical reflection of and on assumptions which involved objective reframing and subjective reframing. The distinction between the objective and subjective reframing is that the former is a consideration of the assumption whereas the latter is a consideration on what caused the assumption to occur. This taxonomy is illustrated in Figure 3.

On the one hand, objective reframing is either (i) a *narrative* critical reflection *of* assumptions and requires critically examining something that was being communicated to a person (e.g., a colleague tells you that attending a two-hour educational technology workshop is not worth the time spent on it) or (ii) an *action* critical reflection *of* assumptions and requires taking a moment to critically consider one's own assumptions in a task-oriented problem-solving situation to define the problem itself (e.g., considering what you believe would constitute the worth of an educational technology project) (see Figure 3).

On the other hand, subjective reframing is, in fact, critical self-reflection *on*, rather than *of*, assumptions (see Figure 3). Subjective reframing can include one of four forms of critical self-reflection on assumptions: narrative, systemic, therapeutic, and epistemic.

- Narrative critical self-reflection on assumptions is the application of narrative critical reflection *of* assumptions to oneself. For example, a teacher, who is told, by a fellow teacher, that the time spent on creating a PowerPoint-based interactive game is not worth it, considers the amount of teacher time devoted to the creation of that game, adds that amount to how long the students are engaged in the activity, and decides that the hours devoted to the creation of the game outweigh the benefits. This demonstrates narrative self-critical reflection *on* assumptions as the teacher critically examined something communicated to him or her (i.e., narrative reflection *of* assumptions), considered the problem as applied to him- or herself, and came to a resolution.
- Systemic critical self-reflection on assumptions is going beyond the action critical reflection *of* assumptions to self-reflect *on* the taken-for-granted cultural influences which in turn, might be organizational (e.g., workplace) or moral-ethical (e.g., social norms). A teacher, who self-reflects *on* the assumption that she cannot learn how to create webpages because of her age, and realises that her age is irrelevant to the learning process is demonstrating systemic critical reflection *on* assumptions.
- Therapeutic critical self-reflection *on* assumptions is examining one's problematic feelings and their related consequences. When a teacher reflects on the belief that she will never learn how to attach a document to an email message and acknowledges that this assumption is because she becomes frustrated so quickly, she is demonstrating therapeutic critical reflection *on* assumptions.

- Epistemic critical self-reflection *on* assumptions is investigating not only the assumptions but also the causes, the nature, and the consequences of one's frame of reference to surmise why one is predisposed to learn in a certain manner. When a teacher self reflects on the fact that her principal's obsession with standardised testing scores has negatively affected her desire to acquire educational technology skills and to take risks with her teaching because she is intimidated by the administrator, then she is demonstrating epistemic critical reflection *on* assumptions.

Mezirow (1998) argued that "learning to think for oneself involves becoming critically reflective of assumptions and participating in discourse to validate beliefs, intentions, values and feelings" (p. 197). In my study, critical reflection of assumptions and critical self-reflection on assumptions were important in educational technology as a great deal of reflection of and on the learning processes and the factors that affected learning occurred when the participants learned technology.

Mezirow (2000) presented the last revision of transformative learning in the edited book entirely devoted to discussing the "theory in progress" (Mezirow, 1991a, p. xi), by elaborating and revising his original terminologies (see Figure 4). He argued that a meaning perspective is a frame of reference and is composed of habits of mind and subsequent points of view. Habits of mind were expanded to include a variety of dimensions: sociolinguistic, moral-ethical, epistemic, philosophical, psychological, and aesthetic (see Figure 4). These perspectives became expressed by teachers as their points of view which were comprised of clusters of meaning schemes (see Figure 4) the latter of which is, "sets of immediate specific expectations, beliefs, feelings, attitudes, and judgments" (Mezirow, 2000, p. 18), which shape a particular interpretation and assign causality. These meaning schemes operate outside the conscious realm of the individual so that one is not aware of their existence. The meaning schemes can be described, as they were in this study, in terms of what one sees and how one sees it. For instance, they can be described in terms of cause-and-

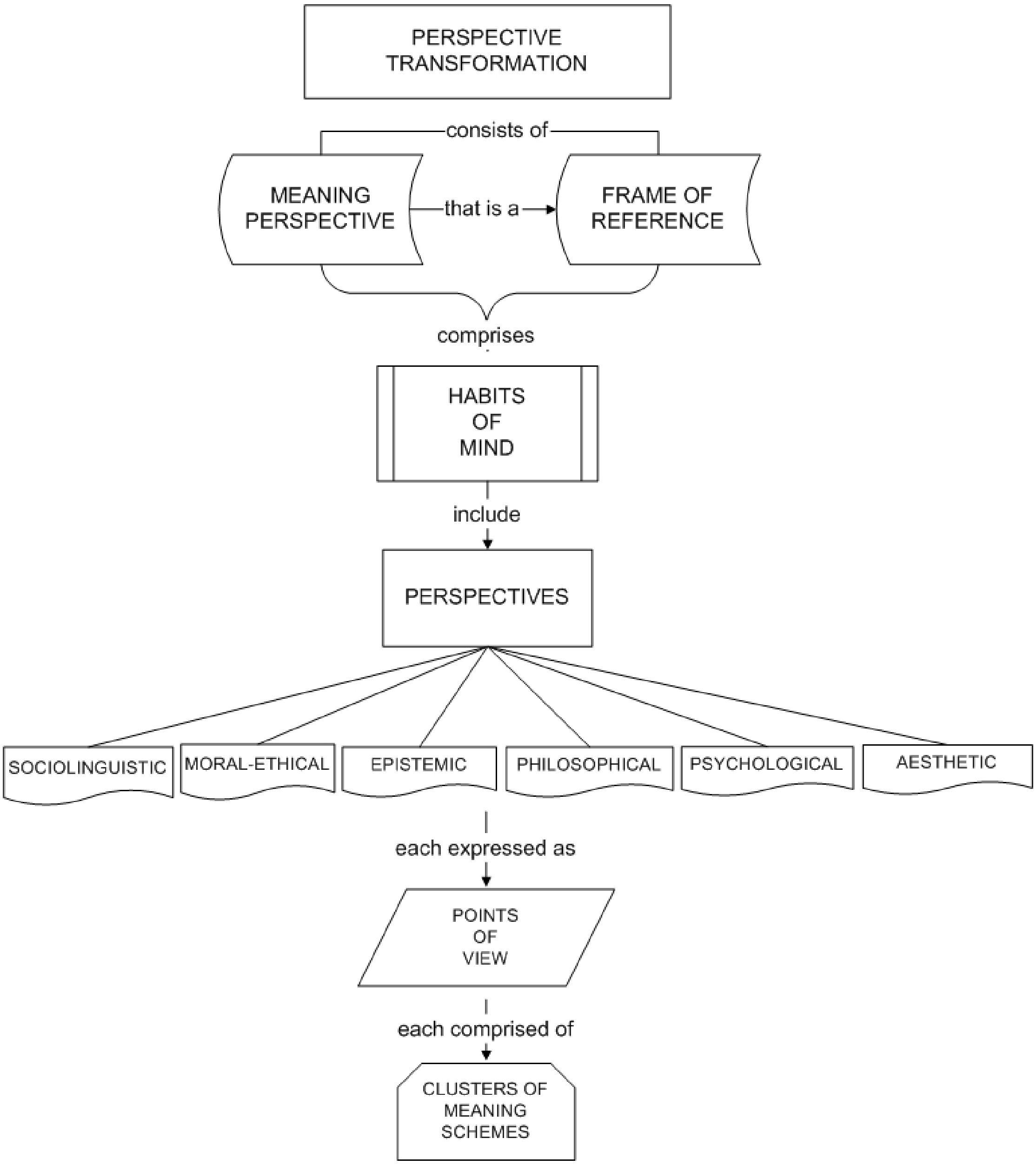


Figure 4. Diagrammatic representation of Mezirow's (2000) revised transformative learning theory

effect relationships, sequences of events, characterisations of colleagues or of the individual. However, because they are habituated in responses, meaning schemes tend to determine a specific chain of events or actions which are followed automatically unless they are considered through critical reflection and critical self-reflection.

Following his previous articulations (Mezirow, 1985, 1991a, 1991b, 1994b) of the three ways learning occurred (expanding on existing frames of reference, learning new frames of reference, transforming habits of mind), Mezirow (2000) added a fourth to reflect the emphasis on transforming points of view (see Figure 5). That is, learning can be elaborating existing frames of reference (or meaning perspective; see Figure 4) and learning new frames of reference, or transforming habits of mind; as well, learning can happen by transforming points of view (see Figure 5). It is important to note that people can change their points of view "by trying on another's point of view" (Mezirow, 2000, p. 21). However, one cannot try on someone else's habit of mind. It would be possible to adopt another teacher's constructivist position of how to use educational technology in the classroom (point of view; see Figure 4).

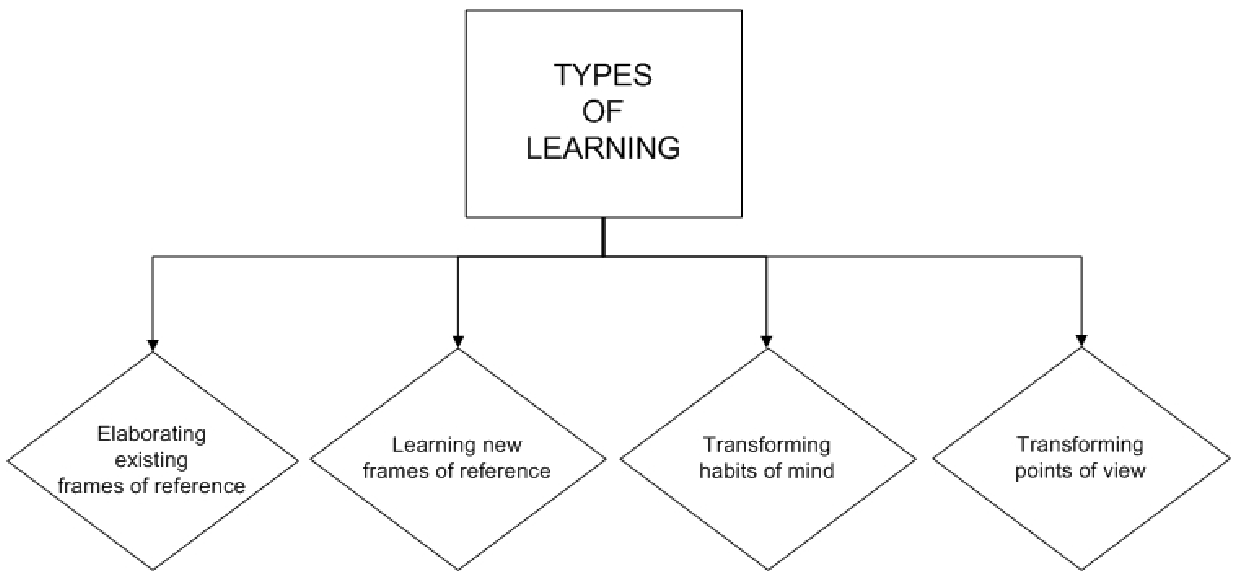


Figure 5. Diagrammatic representation of Mezirow's (2000) four types of learning, reflecting the revised theory of transformative learning

An example will suffice to clarify the difference between point of view and habit of mind. Teacher A can share the point of view that a PowerPoint presentation can replace an overhead projector presentation. However, this does not mean that she has adopted Teacher B's constructivist position of educational technology's role in the classroom (habit of mind). Teacher B believes that all present media (e.g., overhead projector, video recorder and television, blackboard) should be replaced by a laptop and a data projector. Teacher A could easily duplicate the replacement of the media (point of view) but not Teacher B's belief system underlying that replacement (habit of mind). This distinction between point of view and habit of mind is critical when considering the implementation of the effective use of educational technology.

In short, Mezirow's (1985, 1991a, 1991b, 1994b, 1998, 2000) revisions of the initial theory led to a tighter description of the theory. This revision involved an expansion of and a more thorough explanation of the distinct elements of transformative learning theory. In my study, the elements of meaning schemes and perspectives, points of view, habits of mind, frames of references, critical reflection and critical self-reflection proved useful in describing the perspective transformations of the 10 participants.

Transformative learning studies

There have been numerous studies on transformative learning theory in the last 25 years as the theory became more developed. Taylor (1997, 1998) conducted a meta-analysis of transformative learning that divided the research on transformative learning into two general patterns: published papers on the theory authored by researchers in psychology, sociology, philosophy, and adult education, and over 40 unpublished qualitative studies conducted mostly by graduate students for doctoral dissertations (Taylor, 1998). He argued that the seven significant issues identified by his research were: (1) individual versus social change; (2) a decontextualised view of learning; (3) a universal view of adult learning; (4) transformative learning as adult development; (5) an emphasis on rationality; (6) a need for other ways of knowing; and (7) the model of perspective transformation. Several of Taylor's (1997, 1998) aforementioned seven issues have been addressed by researchers in the last few years and will be discussed in this chapter. In addition, Taylor's (1998) Appendix B (pp. 69-74) served as a succinct summary of the empirical research on transformative learning which stayed in the university libraries because the doctoral dissertations were rarely published in journals or books (Taylor, 1998).

Later, in an updated review of transformative learning theory, Taylor (2000) argued that it is

> imperative, in this new millennium, that we set a new direction of research for transformative learning theory that focuses on understanding with greater depth its inherent complexities, that engages a wider range of research designs and methodologies, and that investigates most thoroughly transformative learning as a viable model for teaching adults (p. 286).

Clearly, his meta-analyses demonstrated that there was a need for further and more varied research into transformative learning. This study examined very closely the inherent complexities of transformative learning through the analysis and interpretation of the data related to meaning schemes, meaning perspectives, points of view, habits of mind, and critical self-reflections; used a wide variety of research instruments (teacher professional development plans, reflective journals, questionnaire, semi-structured interview, and my research field notes); and investigated transformative learning theory as a viable model for teaching adults.

Cranton and Roy (2003) and Cranton and Carusetta (2004) have discussed the issue of individual versus social change. Cranton (1994, 1996) previously wrote on a universal view of adult learning and on transformative learning as adult learning. Cranton and King (2003), King (2002a, 2002e, 2003), and LaCava (2002) have conducted extensive research on a need for other ways of knowing and on the model of perspective transformation. As well, this study investigated individual versus social change, a universal view of adult learning, transformative learning as adult development, a need for other ways of knowing, and the model of perspective transformation.

In the inaugural issue of the *Journal of Transformative Education*, there were two articles which were particularly relevant to this study. McWhinney and Marcos (2003) opened “an enlivening dialogue about transformative education” (p. 17) by discussing the distinction among learning, education, and transformation as they pertained to a Navaho healing ritual. Their straightforward definitions of learning and education were the acquisition of knowledge and skills and a path of learning, respectively. However, the more complex process of transformation referred to “those psychological, cognitive, and social processes of learning and education that follow from a variety of reflective and maturing experiences” (p. 18). They concluded their discussion of the Navaho ritual with an argument for four goals of transformative education: (1) career enhancement; (2) personal enrichment; (3) social transformation; and (4) spiritual fulfilment. With the exception of spiritual fulfilment, McWhinney and Marcos’ (2003) goals of transformative education proved helpful in describing teachers’ transformative experiences with educational technology. In particular, these goals were important in addressing part of Research Question 1 of this study which was to examine the factors that assisted or impeded teachers in educational technology within a transformative learning framework.

In the same journal issue, Mezirow (2003) presented an elaboration of transformative learning in adult education and presented a clear definition that has guided future studies: “Transformative learning is learning that transforms problematic frames of reference—-sets of fixed assumptions and expectations (habits of mind, meaning perspectives, mindsets)—to make them more inclusive, discriminating, open, reflective, and emotionally able to change” (p. 58). As the article distinguished between Habermas’ (1984) instrumental and communicative learning and the nature of critical-dialectical discourse, much of the writing was a series of definitions; however, its applicability to the present research design is germane. Mezirow (2003) purported that instrumental learning, with its emphasis on hypothetical-deductive logic, is more suited for quantitative research while communicative learning, involving analogic-deductive logic (i.e., reasoning from concrete example to abstract conceptualisation), is examined better through qualitative methods. For example, a study to examine the degree of influence a technology has on teachers is best researched through hypothetical-deductive, quantitative methods, whereas research conducted with teachers as they learn about educational technology and its related factors to their learning processes would necessitate analogic-deductive logic and, therefore, qualitative methods. As my study examined the degree of perspective transformation experienced by teachers as they developed in educational technology as well as the factors that were related to perspective transformation, both quantitative and qualitative methods, or a mixed-methodology approach (Cresswell, 1995, 2003; Reichardt & Rallis, 1994; Tashakkori & Teddlie, 1998, 2003), were utilised.

Mezirow (2003) concluded his article with a description of the adult-educator's role that serves as a guideline for the practical implications of transformative learning: "Although the educator helps the learner assess and achieve the learner's objective, the professional goal of the educator is to foster the learner's skills, habit of mind, disposition, and will to become a more active and rational learner" (p. 62). This advice was critical for my study as guidance, not only for the participants' construction of professional development action plans, but also for the andragogical approach I adopted for the facilitation of technology skills and strategies.

In the next issue of the *Journal of Transformative Education,* Cranton and Roy (2003) presented a succinct review of the development of transformative learning theory. More critical to my study was their use of the Jungian concept of "individuation" and the ubiquitous concept of "authenticity" to bring together the various perspectives on transformative learning. The authors distinguished among individuation, "the *process* by which we become aware of who we are as different from others" (p. 91, original emphasis), individuality, "our unique characteristics and qualities" (p. 91), and individualism, "focusing on the needs of the self over the needs of others" (p. 91). To Cranton and Roy (2003), individuation is clearly a critical element within transformative learning theory as the "individuation" process emphasises the importance of self-reflection as does transformative learning. The authors defined authenticity as "the expression of the genuine self in the community" (Cranton & Roy, 2003, p. 93). This definition fits well with Mezirow's (1991b) discussion of critical discourse as it involves discussing views within a community of learners and is seen as a central element of perspective transformation. Cranton and Roy (2003) concluded with a table of syllogistic statements to summarize their argument: individuation is transformative, transformation is individuating; becoming authentic is transforming, transformation is becoming authentic; becoming authentic is individuating, individuation is becoming authentic (see p. 96). The article presented a sound argument for the re-framing of transformative learning as it related to individuation and authenticity.

In the 2004 edition of the *Journal of Transformative Education,* Cranton and Carusetta (2004) further developed the notion of authenticity as a transformative process. Over a three-year period, the authors worked with 22 faculty members from varied disciplines to investigate their senses of authenticity in their workplaces. The faculty members were from three Canadian universities but shared a common interest in teaching and learning. There were 13 women and 9 men; 7 participants were new faculty members in the first or second year of full-time teaching while 15 were experienced teachers. The authors interviewed each member once per academic term over the first two years of the study during which the participants discussed the concept of authenticity. As well, the authors observed at least one teaching lesson per year in which they recorded what was happening in the classrooms. In the third year of the study, they conducted focus groups with four to six faculty members, using seven guiding questions based on the data from the first two years of their research.

Cranton and Carusetta (2004) used five inter-related categories of authenticity to describe the data: self, other, relationship, context, and critical reflection. In particular, they presented the argument that educators go through phases of authenticity for each of the five categories; however, they cautioned that the phases were not meant to be discrete nor were the participants necessarily in the same phase for each category. For instance, an individual may be at a beginning phase of self-awareness but be maturely authentic in his or her awareness of context. Ultimately, their research data led them to a clear definition of authenticity as

> a cluster of values related to self-awareness and bringing that self into teaching, understanding of learners and our relationships with them, a positioning of ourselves within a context and taking stances on issues and norms in the workplace and in our social world, and finally, engaging in critical reflection on each of these components (p. 288).

As authenticity involves recognising oneself within a learning community and realising, through critical reflection, that one is the same and different from others, the connection to transformative learning and educational technology is clear. Educators need to separate themselves from the beliefs and assumptions about educational technology of others but also acknowledge that they share common beliefs and assumptions. The process of that recognition involves reconstructing their frames of reference related to the self (Cranton & Carusetta, 2004).

All of these articles from the *Journal of Transformative Education* (Cranton & Roy, 2003; Cranton & Carusetta, 2004; McWhinney & Marcos, 2003; Mezirow, 2003) proved useful in my study as teachers' development in educational technology involved the process of understanding, through critical reflection and transformation of problematic frames of reference (Cranton & Carusetta, 2004; Mezirow, 2003), how they were different from their colleagues in the use, integration, and teaching of technology, which is individuation, but needed to express themselves within their school community, which is authenticity (Cranton & Roy, 2003) related to their maturing experiences (McWhinney & Marcos, 2003).

Transformative learning in practice

Cranton (1994) brought transformative learning to the forefront in Canada and across the world by fine-tuning Mezirow's original (1978a, 1978b) and evolving theory (1981, 1985, 1990, 1994a). Like many transformative learning theorists (Brookfield, 1986; Mezirow & Associates, 2000; Taylor, 1997), Cranton (1994) based her argument on qualitative narrative enquiry rather than on quantitative research, per se, as she had vast experience with adult learners from which to draw. She worked with three groups of adult learners (n = 51) who were enrolled in college-level courses and who were working towards a self-directed learning style. A multitude of suggestions for promoting transformative learning, based on this work with empowering the 51 adult learners, were described and were invaluable for future studies. More importantly, she proposed that there were four linear stages of learner empowerment experienced by adults: (1) initial learner empowerment; (2) learner critical self-reflection; (3) transformative learning; and (4) increased empowerment (i.e., autonomy). These stages not only focussed transformative learning theory on the empowerment of the adult but also the research demonstrated that the empowerment came from the individual's perspective transformation (Cranton, 1994; King, 1997a; Mezirow, 1991).

It was Cranton's (1994) writing that influenced the research that converted perspective transformation theory into action—particularly in the field of educational technology (King, 1997a, 2000, 2002a, 2003; LaCava, 2002). As well, her stages of learner empowerment proved useful in this study to affirmatively answer the second research question. That is, to demonstrate that transformative learning was a viable research framework to describe teacher's development in the use, integration, and teaching of educational technology.

King's (1997a) doctoral dissertation helped fill a quantitative hole in the professional literature (Taylor, 2000). She examined what proportion of adult learners (n = 422) within a higher education context experienced a perspective transformation and what learning activities contributed to the perspective transformation. King (1997a) used a causal-comparative model; the dependent variable was an indication of a perspective transformation and the independent variables were learning activities: "critical thinking exercises, class discussions, student self-evaluations, and discovering one's own voice and support" (p. 27). Drawing on an earlier pilot study (n = 122) in which 48 learners (2.5:1 ratio) indicated that they had experienced a perspective transformation, she designed a survey instrument that measured perspective transformation. The initial instrument went through several revisions and was subjected to criticism by a panel of transformative learning researchers.

The final version, the Learning Activities Survey, had four parts: (1) a listing of the phases of perspective transformation which requires choosing any statement that describes the participant's experience; (2) an identification of learning experiences that contribute to perspective transformation; (3) a series of questions for all participants in the study (i.e., not just the individuals who experienced perspective transformations); and (4) a collection of demographic characteristics.

Of the 737 copies of the survey instrument distributed to four colleges, 471 were returned to the researcher (63.9% return rate). Forty-nine were deemed unusable as they were either incomplete or completed by a person under the age of 21 and therefore not deemed as an adult learner. The remaining 422 surveys were analysed using a perspective transformation index. The perspective transformation index "was a single score that was derived from questions 1, 2, 3, and 5 of the instrument" (p. 37). The first question was a listing of Mezirow's (1978a, 1978b) phases of perspective transformation and the participants were asked to choose any statement that pertained to themselves during their educational experiences at the institution; the second question asked the participants whether they had noticed any changes in “values, beliefs, opinions, or expectations” (p. 96); the third question requested that the respondents describe the experience. The fifth question simply asked: “Thinking back to when you first realized that your views or perspectives had changed, what did your being in school have to do with the experience of change?” (p. 97). The responses to the questions were assigned numerical values and subjected to statistical analysis.

King (1997a) assigned a score of “3” if the respondent indicated a perspective transformation *during* the process of education, a “2” if the participant experienced a perspective transformation at any time and in any form, and a “1” if the student had not identified a perspective transformation. Since only 1.9 percent of the sample scored a perspective transformation index of “2” ($n = 7$), the majority of the analysis involved the perspective transformation indices of “1” and “3”. In order to answer the research question of what proportion of adult learners experienced a perspective transformation, King (1997a) culled the 422 surveys to 374 as the respondents had to answer the first survey question and had to have been in school for more than one semester. Of the respondents who scored a perspective transformation index of “1” or “3”, 367 remained; 137 (37.3%) of those respondents experienced a perspective transformation (perspective transformation index = 3).

In terms of perspective transformation influences, the data (from the “perspective transformation index of 3” respondents) indicated that people (70%), learning activities (68.6%), and life changes (41.6%) were important. King further divided those data into the most frequently-cited learning activities and reported that “class assignments, personal reflection, challenge from a teacher, discussion and assigned readings … were [each] present at least 25% of the time" (p. 58). Eight follow-up interviews were conducted - three men and five women - with respondents who had indicated a perspective transformation. The interview data provided complementarity with the survey results and allowed the researcher to have each respondent expand his or her survey comments. The responses also confirmed that, of the learning activities that promote perspective transformation, the influence of the teacher was major.

King's subsequent research on transformative learning was comprehensive and varied from ESL methodologies (King, 2000b) to instructional technology with teachers (King 2002a), adult basic education instructors (King, 1999), and professors (King, 2000a, 2002c, 2002e; 2003) to empowering women (King, 2002b). Her recommendation for an examination of how best to assist adults in perspective transformation was not novel but it was pointed: "With perspective transformation as a primary objective of adult education theory, and the frequency of its occurrence, it would seem reasonable that adult educators would seek ways to plan for, encourage, recognize and support adult learners through the process" (King, 1997a, p. 74) as well as to set some guidelines for professional development (King 2000a, 2002a).

Cranton's (1994) and King's (1997a, 1999, 2000a, 2000b, 2002a) research on the practical applications of transformative learning theory influenced the design of my study (Chapter 2) as well as the coding and the categorisation of the data (Chapter 3).

Adult-learning principles

Several researchers (Cranton, 1994, 1996; King, 2000, 2002a; Lawler, 2003; Lawler & King, 2000, 2003) have argued that adult-learning principles need to be followed when working with professionals, such as the professional development of teachers (see Table 4). In order to better understand the adult-learning principles, Table 4 provides a summary list of the learning principles from influential andragogical studies.

Table 4: *A summary listing of the adult education learning principles from influential andragogical studies*

	Apps 1991	Cranton, 1996	King, 2002a	Lawler, 1991, 2003	Lawler & King, 2000, 2003	Merriam & Caffarella, 1999	Moran, 2001
Active participation	-	✓	✓	✓	✓	✓	✓
Build on past experiences	-	✓	✓	✓	✓	-	-
Climate of respect	-	✓	✓	✓	✓	-	-
Collaboration	-	-	✓	✓	✓	✓	-
Critical attitude	-	✓	-	✓	✓	✓	✓
Declaration of assumptions	-	✓	-	-	-	-	-
Diverse methods	✓	✓	✓	✓	✓	-	-
Empowerment	-	✓	✓	✓	✓	✓	✓
Genuine feedback loop	-	✓	✓	✓	✓	-	-
Group/Cooperative learning	-	-	✓	✓	✓	-	-
Immediate application	✓	✓	✓	✓	✓	-	✓
Motivation	-	-	-	✓	✓	-	-
Practice-based activities	✓	✓	✓	-	✓	-	✓
Self-directed learning	-	✓	✓	✓	✓	-	-

Active participation

Lawler (1991) argued that an adult-learning instructor needs to create an atmosphere that ensures adults will participate actively in the lesson. The learners must be engaged through the use of varied teaching methods that include lecture, small group discussions, and self reflections (Cranton, 1996). In addition, to encourage active participation from all learners, they need to have input into the learning process in the initial planning stage as well as during and after the learning occurs (Lawler, 2003; Lawler & King, 2000).

Build on past experiences

To build on the past experiences of the learners, the instructor needs to assess the present level of the learners and use that information to plan and implement the professional development (Lawler, 2003; Lawler & King, 2000). By respecting what the learners know before they begin the learning process, the instructor is able to plan activities and discussions that meet the individual learning needs of the participants (Cranton, 1996) and thereby increase motivation to learn (Lawler & King, 2003).

Climate of respect

In order to create a climate of respect, Lawler and King (2000) argued that the adult-educator needs to take into consideration the learning and cognitive styles of the learners, their academic and training backgrounds, and their professional perspectives. This climate of respect leads to an environment that addresses the physical and social needs of the adult learners (Lawler & King, 2000, 2003) and encourages taking risks in a safe environment (Cranton, 1996; King, 2002a).

Collaboration

King (2002a), Lawler and King (2000, 2003), Merriam and Caffarella (1999) and Moran (2001) argued that collaboration is an important element in adult learning. For instance, in his book for teachers of adults, Moran (2001) argued that a successful model for the professional development of adults would be one that integrated the principles of self-directed learning, cooperative learning, and critical reflection. He believed in a collaborative approach so that adults pair off with other adults to form "coaches" and that these coaches would assist each other in meeting their own goals. His guiding principles for collaborative professional development would be effective for all adult-learners: (1) an on-going commitment to promote their own professional development, (2) planning and conducting learning programs, (3) reflecting on their own ways of learning, and (4) a necessary sense of trust between adults (see pp. 16 – 55 for a detailed explanation).

Critical attitude

Cranton (1994, 1996) purported that adult learners need to possess a critical attitude. It is crucial for the instructor to be critical so that adult learners understand that critiquing is not negative but serves the purpose of querying knowledge, skills, and attitudes to better themselves as learners (Lawler & King, 2000, 2003; Merriam & Caffarella, 1999; Moran, 2001).

Declaration of assumptions

According to Cranton (1996), the declaration of instructors' assumptions has to be stated at the outset and revised as the professional development progresses. It is important for the facilitators, responsible for professionally developing the adult learners, to share their assumptions on the presented topic and to invite the opinions of the learners so that the learning environment is clearly collaborative. In this manner, the adult-learners are exposed to varying opinions, points of view, and theoretical positions so that they can discuss the perspectives inside and outside the classroom (Cranton, 1996).

Diverse methods

Lawler (1991) argued that planning a plethora of activities and opportunities into which the participants can delve will increase the learners' participation and subsequent learning. Using not only a great deal of activities but also diverse methods is critical to adult professional development (Apps, 1991; Caffarella, 1994; Cranton, 1996; Galbraith, 1998; Kemp & Cochern, 1994; Lawler, 2003; Lawler & King, 2000). Hence, with teachers who already possess a repertoire of diverse learning and teaching methods, using a wide variety of techniques will not only engage them but also increase their own collection of pedagogical strategies (Cranton, 1996; Lawler, 2003; Lawler & King, 2000).

Empowerment

According to Moran (2001), adult learners must have an active role in, and input into, their own learning and should be encouraged to assist in the planning of professional development opportunities. In fact, the goal of any professional development program for adults has to be empowerment (Lawler, 2003; Lawler & King, 2000). In other words, if the learners believe that they are empowered (Cranton, 1996), they are more likely to not only cooperate in the learning process but also to collaborate with each other and with the facilitator. In addition, this empowerment leads to ownership of the learning process (Apps, 1991).

Genuine feedback loop

Lawler (1991) argued that adult learners need to be provided with a genuine feedback loop so that they can give and receive responses to and from the instructor. In educational technology, the need is great due to the constantly-changing and rapid pace inherent in acquiring technology skills (King, 2002a). Open discussion has to be encouraged in adult learning (Cranton, 1996). All participants in the learning community need to benefit as the instructors hear others' opinions and, along with the other learners, be open to clarifying the instructors' perspectives. As well, if suggestions made to the instructor are reflected in subsequent lessons, the learners realise that their input is valued and tend to become more motivated (Lawler, 2000; Lawler & King, 2000, 2003).

Group and cooperative learning

There is consensus among researchers that using group and cooperative learning not only allows the instructor to vary andragogies but also creates opportunities for the adult learners to share their expertise and experiences with each other (Cranton, 1996; King, 2002a; Lawler, 1991, 2003; Lawler & King, 2000, 2003). Cranton (1996) argued,

> a group of educators who meet regularly over an extended period of time, and who develop trust and confidence in each other, may be more likely to stimulate critical reflection on their practice than is the developer working alone with an educator or leading a one-time discussion (p. 191).

In other words, rather than seeing themselves as working in isolation, adult learners come to understand the advantages of working with each other, inside and outside the classroom, to complement and extend the information received in professional development sessions (Lawler, 2003).

Immediate application

Based on the research of Lawler (2003) and Lawler and King (2000), adult learners need to use the skills and knowledge acquired in professional development sessions so that immediate action can be implemented. Adult learners, especially teacher-learners, have a “preference for the practical” (Apps, 1991, p. 42) so it is imperative that what they learn is something that can be used effectively within a short period of time after the learning has occurred (Cranton, 1996; King 2002a; Lawler, 1991, 2003; Lawler & King, 2000, 2003; Moran, 2001). For instance, teachers attending a professional development workshop not only need to take that knowledge and apply it as soon as possible but also need to understand, at the time of the learning opportunity, how that knowledge can be applied to their everyday teaching (King, 2002a; Moran, 2001).

Motivation

Based on logic, there is sufficient evidence in Lawler’s (1991, 2003) and Lawler and King’s (2003) studies to assume that the motivation of adult learners is a crucial element to professional development but it is often omitted from professional development models. Lawler and King (2000) argued that it was one of the most challenging aspects of effective professional development as motivation is equally crucial in the working and daily lives of adult learners.

Practice-based activities

According to Apps (1991), Cranton (1996), King (2002a) and Moran (2001), activities based on practice have to be presented to adult learners. The learners need to know that what the instructor purports is practical but based on theory. For instance, if an instructor uses a case study as an exemplar (Moran, 2001), the adult learners would require evidence that the case is based on real-life experiences as well as on sound theory (Lawler & King, 2000, 2003).

Self-directed learning

Cranton (1996) concluded from her qualitative research with adult learners that best practice should ultimately be self-directed learning as it leads to personal autonomy, self management, learner control, and autodidaxy (intentional self-education). In addition, others argue that self directed learning can lead to critical self-reflection and perspective transformations (King, 2002a; Lawler, 1991, 2003; Lawler & King, 2000, 2003).

A concrete example of several adult-learning principles in action (genuine feedback loop; collaboration; immediate application; and empowerment) is found in my earlier research (Kitchenham, 2001a, 2001b, 2001c, 2003) with a small sample of elementary teachers (n = 10) in a two-year study. In the first year, the teachers were assisted in developing and implementing a professional development action plan for educational technology (Kitchenham, 2001a, 2001b, 2001c). The primary interest was the motivators and inhibitors for the success of the technology plan. Success was measured by the teacher's completion of the plan and their placement on a researcher-created technology continuum (Kitchenham, 2001a). Five teachers were interviewed and asked to discuss what causes contributed to their success or lack of success. The interviews were transcribed and analysed using qualitative analysis software (NVivo). The teachers reported that the motivators were: administrator support (100%), peer discussion (80%), a sense of ownership of the learning process (80%), a sense of empowerment (80%), and applicability to the classroom (80%). The inhibitors were reported as: fast-paced instruction (100%), insufficient time (100%), an over-zealous peer (80%), a sense of being alone (80%), and lack of money (60%).

In the second year of the study (Kitchenham, 2001c, 2003), the focus examined how best to assist teachers in their technology use (i.e., lesson preparation), integration (i.e., using it within the classroom), and teaching (i.e., formal pedagogy). The salient findings from this second year were the notions of “web-ability” and “web-capability” (Kitchenham, 2003). First, a learner-needs analysis revealed that the teachers knew elements of technology - the “what” of technology - but not necessarily the “how” and “why” of technology, or “web-capability.” The moniker, “web,” was not specific to learning and teaching about, on, and through the worldwide web (WWW) but rather was a general term for a learner’s ability to work with technology within a complex network of inter-related concepts and strategies, or a web.

Professionally developing the teachers in technology, and therefore moving them from “web-ability” to “web-capability,” was successful when the following strategies were implemented (Kitchenham, 2003). First, it showed what the learners wanted to learn and how quickly they wanted to learn the information through a genuine feedback loop of email and face-to-face conversations (Kitchenham, 2003; also see Cranton, 1994, 1996; Holzberg, 1997; Lawler & King, 2000; King, 2002a; Moran, 2001). Second, collaboration between the facilitator (myself) and the adult-learners and among the adult-learners themselves was consistent (Kitchenham, 2003; also see Cranton, 1994, 1996; King, 2002a; Lawler & King, 2000, 2003; Moran, 2001). Third, immediate action was taken by the participants with respect to the skills and strategies acquired in the professional development workshops (Kitchenham, 2003; also see Apps, 1991; Lawler & King, 2000; Merriam & Caffarella, 1999). Lastly, the learners were empowered by providing frequent opportunities for success and altering the learning process, after critical analysis, when the adult-learners requested a change in material, approach, or assessment (Kitchenham, 2003; also see Cranton, 1994, 1996; King, 2002a, 2002e, 2003; Lawler & King, 2000; Taylor, Marienau, & Fiddler, 2000).

As revealed in Chapter 2: Research Design, this study heeded the research (Apps, 1991; Caffarella, 1994; Cranton, 1994, 1996; Galbraith, 1998; Holzberg, 1997; Kemp & Cochern, 1994; King, 2000; Lawler, 1991; Lawler, 2003; Lawler & King, 2000; Moran, 2001). Therefore, I (a) ensured that the participants were frequently engaged in hands-on learning activities and group discussions (active participation), (b) pre-assessed the participants to ascertain their educational technology goals (build on past experiences), (c) addressed their needs in a timely fashion (climate of respect), (d) encouraged the participants to share their knowledge via group email messages or face-to-face discussions (collaboration; group/cooperative learning), (e) used varied andragogical techniques (diversity of methods), (f) ensured that the participants received relevant resources and materials to support their professional development plans (empowerment), (g) corresponded with each participant throughout the research study (genuine feedback loop), (h) created practical opportunities and examples (practice-based activities) to be used very soon after the demonstration (immediate application), (i) demonstrated how educational technology could be used in the respective classrooms of each participant (motivation), and (j) requested that each participant complete a professional development action plan (self-directed learning).

Professional development of adults and transformative learning

Lawler and King (2003) further expounded their integrative approach to professional development (Lawler & King, 2000). They argued that professional development is adult education, is learner-centred, is transformative learning, needs to address motivation, and needs to address technology learning, an imperative for the 21st century. Lawler and King (2003) purported that many professional development facilitators teach their adult learners as if they were students rather than fellow adult learners and so use a flawed professional development approach.

Lawler and King (2003) argued that there needs to be a teaching and learning paradigm shift so that the learners' educational technology skill needs are addressed first and the role of the instructor, therefore, moves from androgogue to facilitator. Lawler and King (2003) put forth the assumption that professional development of adults is transformative learning as it is an "opportunity to cultivate reflective practice, challenge assumptions, beliefs, and values, and engage in meaning-making … [so that learners can] transform themselves and their perspectives" (p. 88). Citing the professional literature and their own experiences, Lawler and King (2003) stressed the importance of motivation in professional development. They perceived motivation as key to the learning and change processes of adult learners but emphasised that it is often omitted from professional development models. Finally, Lawler and King (2003) outlined the need to address educational technology learning in professional development so that the learners obtain strategies for dealing with the rapid and constantly changing challenges of educational technology in the learners' workplaces and personal lives.

Cranton and King (2003) outlined five strategies for adult professional development that could encourage or promote transformative learning: action plans, reflective activities, case studies, curriculum development, and critical theory discussions.

Learner-devised action plans, in collaboration with the instructor, allow the professional development facilitators to orchestrate the activities for the adult-learners along a specific timeline so it is clear what the learners want to learn and how quickly they would like to acquire the skills. Action plans also accustom the learners to the process of critical reflection as they consider the teaching and learning processes in their own classrooms. Reflective activities are used by the developer to ensure that the participants critically examine perspectives, assumptions, beliefs, and concepts involved in their learning processes. Case studies serve as a clear focus for the adult-learners to analyse familiar and unfamiliar situations, pose questions, offer solutions, and make recommendations. Curriculum development through professional development workshops creates opportunities for the adult-learners to explore new strategies and materials, practise on each other, and become familiar with the pedagogy and curriculum before using them in their classrooms. Critical theory challenges the adult-learners to be "not only critically examining the purposes and meaning of information but also being guided to question their purposes and meaning in selecting and providing information for their classes" (Cranton & King, 2003, p. 36). In other words, adult-learners come to examine the theory behind their practice rather than blindly accepting strategies because they are espoused by the perceived more-knowledgeable instructor. In this manner, adult-learners realise that critically examining the content of the information presented in their own classrooms can lead them to critically reflect on the reasoning behind selecting the information initially.

The adult-learning assumptions and strategies that promote transformative learning proved useful in the design of this research study. Lawler and King's (2003) five assumptions about professional development were considered in the research design for my study—especially the emphasis on motivation and technology learning. As well, Cranton and King's (2003) five strategies of adult professional development were helpful in fine-tuning my professional development model (Kitchenham, 2003) through the use of action plans, reflective activities, case studies, curriculum development, and critical theory discussions.

Technology innovation and school change

There are numerous books and articles dealing with the theoretical and pedagogical implications of educational technology (e.g., Bitter & Pierson, 1999; Chen, 2002; Ely & Plomp, 1999; Grabe & Grabe, 2000; Heide & Henderson, 2001; Heide & Stilborne, 1999; Jonassen, 2000; Mills & Ragan, 2000; Norton & Wiburg, 1998; Roblyer, 2003a, 2003b; Schwartz & Willing, 2001; Tomei, 2002; Valmont, 2003). Specific to my doctoral study, the professional literature discusses technology innovation and diffusion and its likelihood of leading to school change (Bates, 2000; Casey, 1996; Dede, 2000; Eshet, Klemes, Henderson, & Jalali, 2000; Fullan, 1999, 2001a, 2001b; Fullan & Hargreaves, 1996; George & Camarata, 1996; Hargreaves, 2003; Kozma, 2003a; Means & Olson, 1995; Means, Penuel, & Padilla, 2001; Mulkin, 2003; Pearson, 2003; Rogers, 1995; Sandholz, Ringstaff, & Dwyer, 1997; Sashkin & Egermeier, 1992; Schiller, 2002; Schofeld & Davidson, 2002; Stuve, 1997; Yelland, Grieshaber, & Stokes, 2000). In my study of transformative learning and technology, the teachers were self- and other-identified as innovative as evidenced by their roles as educational leaders as described by their respective administrators and indicated in their journal entries, questionnaires, and semi-structured interviews. It stands to reason that if they were innovative in their teaching of Language Arts, Mathematics, Science, and Social Studies, they had the predisposition to be innovative in their teaching of educational technology. To this end, I have chosen to examine the common elements, across varied studies, of implementing technology innovation.

Technology innovation does not appear to be related to the learner's gender, age, wealth, or access (King, 2002a; Kitchenham, 2001c; Kozma, 2003a, 2003b, 2003c; Ungerleider & Burns, 2002) but rather to the school culture (Kozma, 2003a) and a shift in the teacher's role (President's Information Technology Advisory Committee, 2001). In order to frame the professional literature review, a working definition of technology innovation is offered as technology-based and technology–related teaching practices that involve a change in role for the teachers which result in a change in the way their students learn. In other words, "it is not having a lot of technology or even the most sophisticated technology that matters most for educational change—it's how you integrate it into the curriculum" (Kozma, 2003c, pp. 53-54). To what degree collaboration occurs and to what extent teachers are empowered to use technology effectively are indicators of technology innovation. In short, technology innovation occurs when the school decides that change needs to occur and/or when the teacher or teachers decide that a change in role must happen (Bates, 2000; George & Camarata, 1996; Hargreaves, 2003; Means & Olson, 1995; Means, Penuel, & Padilla, 2001; Pegrum & Anderson, 1999; Sandholz, Ringstaff, & Dwyer, 1997; Schofeld & Davidson, 2002; Stuve, 1997). Five studies stand out as exemplars of technology innovation due to the fact that they are longitudinal and/or in depth in their design and analysis of technology innovation.

McGhee and Kozma (2000) conducted a one-year study in which they surveyed a sample of 500 teachers in 140 schools from 12 of the 15 countries participating in the 1999 World Links for Development (World Links for Development) program launched by the World Bank Institute. The African and South American schools were provided with software, hardware, and training by World Links for Development workshop leaders knowledgeable in both technology skills and best practices across the curriculum. The 500 teachers learned how to use the Internet for teaching and learning, were introduced to educational telecollaborative projects, learned how to integrate technology into the curriculum, and how to diffuse and evaluate innovative classroom practices. In short, the primary and secondary teachers were provided with similar technology education as are many North American teachers. Of the four stated goals for the project, one was pertinent to this study: “Examine the differences between WorLD [World Links for Development] and non-WorLD schools in terms of teachers’ pedagogical practices, their uses of computers, and their assessment of the impact of computers on learning outcomes” (p. 1).

The authors found two relevant trends. First, both World Links for Development (n = 67) and non-World Links for Development (n = 310) teachers reported that computers were predominantly used by computer science and mathematics teachers. Interestingly, the software tools in these classrooms were used for problem-solving tasks rather than for more traditional word and data processing activities (McGhee & Kozma, 2000). Second, approximately one-half of the World Links for Development teachers (48%) collaborated with their colleagues compared to the non-World Links for Development teachers (11%). It would appear that technology innovation and diffusion might be related to subject content and collaboration with colleagues.

Burns (2002) also found collaboration to be a major indicator of technology innovation. She and her colleagues from the Southeast Educational Development Laboratory (SEDL), in Austin, Texas, conducted a two-year study entitled, *Applying Technology to Restructuring and Learning*, with 160 K – 12 teachers with an aim to assist the teachers in creating technology-supported and student-centred learning environments. The six schools were deemed “at-risk” as the students scored poorly on the state examinations, attended school infrequently, and came from low socio-economic backgrounds. Each school had a group of teachers at either end of the technology experience scale and a computer/student ratio of 1:25 to 1:35. At the beginning of the study, the teachers did not use the computers very often and when they did, they used skill-and-drill software: “Indeed, the defining image of technology was that of a corpse: computers, still and silent, covered by sheets” (Burns, 2002, p. 296). Over the course of two years, the 25 to 30 volunteer teachers in each of the six schools received 72 hours of professional development. The Southeast Educational Development Laboratory staff attempted to simulate the learning environments encountered by the teachers in the study.

The facilitators followed the same format for each professional development session. The workshops took place in the library or in a small classroom with one to four computers which was similar to the computer/student ratio experienced by each teacher. The facilitators began every session with the teachers sharing their experiences of using the technology-based learning-centred approaches in the time between their last workshop and the new professional development session. These sharing sessions were followed by project- and problem-based tasks in which the participants were placed in collaborative groups to work on a project, using the software that they all had in their respective classrooms. Eventually each small group presented their finished projects, explained how they would use them with their students, outlined the obstacles for successful implementation of the technology, and discussed how they would address the obstacles.

The Applying Technology to Restructuring and Learning team had started with three assumptions about the connection between technology and teaching: (1) teacher proficiency with technology lead to an increase in student use and in learner-centred instruction, (2) the best method for learning technology was to link it to specific content areas, and (3) the more technology the teachers had, the more they would use it and the greater the chance of creating learner-centred environments. Burns (2002) reported that she and her team found that none of three assumptions held true but rather it was the change in teacher roles, the passion for learning, and the opportunity to collaborate with others that predicted success. In fact, pertinent to the present study, Burns (2002) had the teachers complete a survey on their technology and learner-centred environments and found a “66% increase in ‘working with other teachers within the school on curriculum development,’ [and] a 62% increase in conversations with colleagues” (p. 297). As a corollary, the teachers also reported that their colleagues, who were not involved in the Applying Technology to Restructuring and Learning project, became more involved and more apt to use technology in their classrooms—primarily based on the enthusiasm of the project teachers and the markèd increase in student achievement (Burns, 2002).

Kozma (2003a) and his colleagues conducted a comprehensive three-year study of 28 countries based on 174 case studies of innovative pedagogical practices with technology for the Second Information Technology Education Study (SITES) Module 2 Report sponsored by the International Association for Evaluation of Educational Achievement (IEA). An international definition of technology innovation was eschewed as the team did not want to be prescriptive in the definition. Instead, each country was asked to nominate a case study of innovation based on four universal criteria: (a) significant pedagogical, learning, or curricular changes occurred; (b) technology contributed significantly to these changes; (c) positive outcomes for either the students or the teachers occurred because of these changes; and (d) the changes were sustained and transferred to other areas (Kozma, 2003c). These criteria resulted in more than 220 final nominations from which 174 case studies were taken; the 46 remaining case studies were rejected based on either their not meeting all four criteria upon closer examination by the International Coordinating Committee of six scientists from Canada, The Netherlands, and the United States or their not being available to participate at the time of the research (Kozma, 2003b). The representation of cases ranged from

> 1 (Japan) to 12 (Germany) [with an average of] 6 cases per country [but were not seen as] representative or 'typical' of what is happening in countries around the world [but should be] seen as representing what national panels saw as the best practices in their countries based on the international and local criteria (Kozma, 2003b, p. 4).

In other words, the cases were the best of the best from each country.

The data from Kozma's (2003b) and his colleagues' case studies included semi-structured interviews, classroom observations, and archival documents such as lesson plans and student work. These data were analysed using a mixed-methodology approach (Tashakkori & Teddlie, 1998) in a two-phase process. In the first phase, all the cases were read and classified by the International Coordinating Committee using a list of set variables related to the research questions (Kozma, 2003a) such as age, gender, relation to national standards, or to the school's technology plan, kinds of technology, and solutions to technology problems. As well, they "used the macro, meso, and micro components of the conceptual framework to identify specific factors that could characterize the kind of practices that constitutes an innovation and the contextual factors that might be associated with it" (Kozma, 2003a, p. 35). In the second phase, the International Coordinating Committee used an eight-solution cluster analysis to analyse data from the preceding phase as related to the specific research questions on ICT and innovative classroom practices; ICT and the curriculum; ICT in the schools; and ICT policies. The results, from both phases, on innovative classroom practice suggested possible activities and provided evidence for technology innovation professional development with the participants in my study.

Although data from the two phases revealed interesting overall trends, two were most pertinent to my study: the degree of collaboration and the types of technologies used in the technology innovation. The qualitative analysis of the case studies demonstrated that 90% of the teachers provided advice and collaborative guidance to their students on improving their work (Kozma, 2003b). Collaboration appeared to be a significant innovation as approximately 59% of the cases reported working with other teachers and another 23% reported working with experts outside of the classroom, such as university and college professors, scientists, and business people. Specifically, the impact of the collaboration was seen in the development of ICT skills (63%) and pedagogical skills (57%); as a corollary, 35% of the cases indicated that they acquired collaborative strategies as a result of the collaboration. The analysis also listed the forms of technology applications that were used as part of the innovation: productivity tools (78%), Web resources (71%), email (68%), multimedia software (52%), Web design tools (34%), and specialised educational software (13%) (Kozma, 2003b). The findings that collaboration was a significant factor in technology innovation and that there were specific technologies that indicated innovation provided me with support for my own professional development model (Kitchenham, 2001c, 2001d) that provided the scaffolding for opportunities for the participants to collaborate with each other and to choose their own specific software programs.

The statistical data from the second phase that examined the specific research questions on ICT and innovative classroom practices; ICT and the curriculum; ICT in the schools; and ICT policies resulted in seven clusters: (1) tool use, (2) student collaborative research, (3) information management, (4) teacher collaboration, (5) outside communication, (6); product creation, and (7) tutorial and drill and practice software (Kozma & McGhee, 2003). Teacher collaboration is taken to be the most pertinent cluster to this present study and will, therefore, be discussed in some detail.

In this cluster, upper secondary teachers (57.9%) were most apt to collaborate with each other across and within subject disciplines as opposed to lower secondary (31.6%) and primary (15.8%) teachers. In addition, over 30 percent of secondary physics (36.8%), earth science (36.8%), history (31.6%), and mother tongue (31.6%) teachers reported teacher collaboration. This percentage is in comparison with approximately one-quarter of secondary math (26.3%), biology (26.3%), creative arts (26.3%), geography (26.3%), and foreign language (21.1%) teachers and fewer than 20 percent of computer science (15.8%), civics (15.8%), chemistry (10.5%), economics (10.5%), and vocation (10.5%) teachers. It should be noted that Kindergarten to Grade 7 teachers were considered multi-disciplinary and therefore those data were not broken down by subject area. In short, it would appear that the nature of the subject area and the grade level may be predictive of technology innovation in my study.

As part of the Second Information Technology Education Study – Module 2 research project, Anderson (2003) reported on stellar case studies of technology-supported pedagogical innovations. He reviewed cases from 22 countries: nine primary, four kindergarten to grade 12, and nine secondary-level schools. The school size varied from 100 students to more than 3,000 and included all subject areas. Of the 22 case studies, 14 involved collaboration as an indicator of technology innovation. These three case studies stood out because of their relevance to the present study in respect to the teacher and the teacher-principal cooperation.

The first of these cases reported by the Australian researchers was that of Woodcrest College which is located near Brisbane, Australia, and served 1,100 preschool to Grade 10 students. The innovative project consisted "of an instructional program where the shared vision was that of staff and students functioning together as a learning community, with a constructivist philosophy and heavy utilization of collaboration and ICT to achieve the vision" (Anderson, 2003, p. 212). The school was selected as the second Apple Classrooms of Tomorrow (ACOT) site in Australia and had over 300 Apple Mac computers with five or more of these computers, and at least one printer, located in each classroom. In addition, the teachers usually met on a weekly basis to discuss innovative ICT strategies and new teachers were paired with teachers who possessed a higher level of ICT skills and pedagogy.

The second stellar case was from the Canadian team of researchers. Mountview is a kindergarten to grade 8 school of 437 students with 137 fully-networked computers utilised across all subject areas. The networked computers were situated in clusters of five to eight computers, attached to printers, around the school and in a dedicated computer lab. Every computer in the school was equipped with the same bundles of software packages so that all students and teachers could access the same computer programs wherever the class was located. The innovative project began with a group of 10 teachers and the principal planning to meet their school goal of a school where teacher reflection, experimentation, and risk-taking were sought. It was "noteworthy … that it was accomplished without special funding or other special resources" (p. 214). Ultimately, the project was deemed a success as ICT was infused across all content areas, students worked collaboratively and cooperatively, and teachers co-planned across grade and subject levels.

The third and last case study, New Tech High School in northern California, was a grade 11 and 12 school of 240 students. This school was atypical of most schools as there was at least one computer with Internet access for each student - largely based on the fact that outside funding was sought and obtained. The students spent a great deal of their time working on computers in classrooms that had glass walls and office desks. The teachers collaborated extensively with each other and with the outside community so that students were prepared for work in the technology field. In addition, most classes were cross- and inter-disciplinary and team taught.

From these three case studies reported by Anderson (2003), it is quite clear that collaboration in planning and teaching is an exemplar of technology innovation and this fact may prove relevant to my study of transformative learning and technology.

In an effort to combat the "virtual stalemate" of teachers needing to "play the lead role and assume the major responsibility for the trial and error, the research, and the development required [for technology innovation and diffusion but having] neither the training, the expertise, nor the time" (p. 128), Romano (2003) proposed the Technology-Enhanced Curriculum. He argued that "the stages of instructional evolution" (Sandholz, Ringstaff, & Dwyer, 1997, p. 37) proposed by Apple Classrooms of Tomorrow (ACOT) did not account for a reasonable phasing in between the adaptation and the transformation models. The adaptation model is where "technology is thoroughly integrated into the classroom in support of existing practice" and is essential in reaching the transformation model in which "technology is a catalyst for significant changes in learning practice; where students and teachers adopt new roles and relationships" (p. 37). The Technology-Enhanced Curriculum bridged the gap between the adaptation and transformation models so that teachers could use technology and continue to do what they were doing—only better. In other words, technology innovation involved a change in the role of teachers so they used technology as another tool rather than as a replacement for other teaching tools. Pertinent to the present study, the Technology Enhanced Curriculum involved the teachers in the process of deciding what each of their needs were (based on assessing their own students) and using their particular expertise "to *plan*, *communicate*, *guide*, and *evaluate* more effectively" (Romano, 2003, p. 111, original emphasis) the present technology rather than being given a set of technologies and being told what to do. Romano (2003) claimed that this act lead to technology innovation and diffusion as teachers augmented their skills as the need arose.

The common element across the aforementioned studies on technology innovation and school change is the notion of collaboration. This datum suggests that the research design of professional development workshops should encourage collaboration among the teachers and between each teacher and their respective students. The research studies additionally suggest educational technology classroom topics be derived from the teachers' requests via professional development action plans or communicated through email and face-to-face conversations. As shown in Chapter 3, these characteristics were incorporated into my research design.

Transformative learning and technology

A 2005 Google and Scholar Google search, in English, revealed that there are a dearth of studies that combine transformative learning and technology. Given the small number, each study will be discussed in some detail in order to frame and legitimize the present study.

The vast majority of research on transformative learning and computer technologies was conducted by King (1999, 2000a, 2001, 2002a, 2002b, 2002c, 2002d, 2002e, 2002f, 2003). King's (2000a) study is very similar to this present study as both were conducted with a convenience sample and used a mixed-methodology research design. In King's (2000a) case, it was with 175 teachers and teachers-in-training (n = 175; 132 females; 43 males) in a New York City graduate school of education. The convenience sample was predominantly female (75.4%), White, non-Hispanic (71.3%), had an average of 10 years of teaching experience (M = 10.334 with a range from 0 to 40 years), and a mean age range of 30 to 39 years of age. One-third of the convenience sample, or 58, the teacher participants, were not obtaining a graduate degree but were taking the technology courses through a subsidised program for professional development. Over one-third of the 175 teachers and teachers-in-training were in their first semester of study (34.6%), over two-thirds (69.2%) were in their first three semesters, and a cumulative 91.2 % were at the university for six or fewer semesters. The ICT courses were delivered in a variety of formats from discussions to hands-on experiences to synchronous and asynchronous on-line conferencing. In total, the participants completed 175 surveys, 633 journal entries, and 19 reflective essays about the professional development experience.

An adapted Learning Activities Survey (King, 1997a, 1997b, 1998, 1999) was used to detect the presence of perspective transformation in King's (2000a) study. Those teachers who had experienced a perspective transformation (n = 45) were selected for in-depth interviews. The final analysis of data combined quantitative and qualitative research methods that included "individual effects, frequencies, proportions, and coding of free responses and interviews" (King, 2000a, p. 212) as well as "a phenomenological perspective of identifying emergent themes through constant comparison [for the] substantial data source of survey free-responses, follow-up interviews, journal entries, and reflective essays" (King, 2000a p. 212).

In the initial screening process, King (2000a) reported that 156 of the 175 educators and pre-service teachers (89.1%) experienced a perspective transformation during the technology courses. As part of the survey instrument, respondents were asked to choose which learning activities contributed to their perspective transformations and were reported with the following frequencies: class discussions (40.6%), specific computer-based projects (38.3%), hands-on activities (38.3%), reflective activities (32.0%), class exercises (28.0%), and below 25 percent for each of class presentations, journaling, the structure of the class, self evaluation, writing, and the research papers. It should be noted that they could indicate more than one contributor so the total of percentages exceeded 100.

King (2000a) discovered two dominant themes running through each learning activity of the 45 teachers' perspective transformations: empowerment and a changed worldview. That is, these teachers felt a new sense of looking at their broad perspective of learning and experienced more confidence and expertise in educational technology use which resulted in a feeling of empowerment (King, 2000a). They examined tasks with a new frame of reference and experienced the subsequent empowerment in their teaching, planning, and assessment. Additionally, many teachers saw their worlds through a different perspective or lens. They reported that they approached technology-based tasks—especially Internet-related activities—as a way of exploring the world beyond textbooks and movies. In short, the teachers saw educational technology not only as "an entryway to accessing information [but also as] a whole new world of opportunity" (p. 214). Those opportunities were also described by the participants in this study.

Continuing her previous research (King, 1997a, 1997b, 1998, 1999, 2000a), King (2002a) wrote a book outlining how schools and teachers could use educational technology within a transformative learning framework. She followed this framework by a research article (King, 2002e) that discussed the research design and implications of this book (King, 2002e). She (2002e) explored the perspective transformations, learning activities, and experiences of 205 (n = 205; 155 female; 50 male) teachers (n = 169) and teachers-in-training (n = 36) who were enrolled in technology courses in graduate schools of education. Data were collected at the beginning and end of each one-semester course over a seven-year period. The convenience sample was predominantly female (75.6%), White, non-Hispanic (66.3%), had an average of 10 years of teaching experience (M = 10.530 with a range from 0 to 40 years), and a mean age range of 30 to 39 years of age. Less than one-half were in their first semester of study (40.9%), over two-thirds (72.5%) were in their first three semesters, and a cumulative 91.0 % were at the university for six or fewer semesters.

Using a revised form of the Learning Activities Survey (King, 1997a, 1997b, 1998, 1999) which focussed the questions on educational technology, the Learning Activities Survey- Professional Development in Technology (LAS-PD TECH) instrument to ascertain which of the 205 participants had experienced a perspective transformation. The LAS-PD TECH was a “4-page survey present[ing] free-response, checklists, completion statements and extended responses to identify potential perspective transformation experiences educators have had through the professional development sessions” (King, 2002e, p. 197). From the 205 participants, King (2002e) selected 58 respondents for in-depth interviews.

In addition to the 205 surveys, the participants completed a total of 748 journal entries, and 25 reflective essays about their technology professional development experiences. The surveys (n = 205), 44 long-term (more than two hours) and 14 short-term interviews (fewer than two hours), and the reflective essays (n = 25) were completed at the conclusion of the course. However, the 748 journal entries from all 205 participants were submitted throughout the course via email to her. The design and findings from King's (2002a) were similar to my study; however, my study delved much deeper into the degree of perspective transformations and connected the perspective-transformation-related factors to the school culture (Hargreaves, 2003).

Table 5 summarises the findings from King's (2000a, 2002a, 2002e, 2003a) and LaCava's (2002) studies on educational technology and transformative learning in practice; in particular, the frequencies of persons and types of intervention facilitating perspective transformations. These findings were used for comparative purposes with the research findings from my study to highlight the similarities and differences among the studies.

Table 5: *Transformative learning in practice: Summary of key findings*

Author	Category	Finding (in percentage)
King, 2000a	Perspective transformation	89.1
	Facilitating factor:	
	• Class discussions	40.6
	• Computer-based projects	38.3
	• Hands-on activities	38.3
	• Reflective activities	32.0
	• Class exercises	28.0
	• Class presentations	>25.0
	• Journaling	>25.0
	• Class structure	>25.0
	• Self evaluation	>25.0
	• Writing	>25.0
	• Papers	>25.0
King, 2002a, 2002e	Perspective transformation	100
	Facilitating factor (people):	
	• Teacher support	35.8
	• Teacher challenge	26.0
	• Classmate support	14.2
	• Other student support	11.3
	• Another person	10.3

	Facilitating factor (activity):	
	• Discussing concerns	44.1
	• Curriculum project	40.7
	• Lab experiences	40.7
	• Independent reflection	32.4
	• Assigned readings	31.4
	• Class exercises	28.9
	• Teacher challenge	26.0
	• Class presentation by another	21.5
	• Class presentation	20.5
	• Journaling	19.1
	• Class structure	17.6
	• Writing	12.7
	• Self-evaluation	12.2
	• Papers/Essays	10.3
	• Other	4.4
LaCava, 2002	Perspective transformation	94.6
	Facilitating factor (people):	
	• Teacher	64.2
	• Friend	50.9
	• Student	18.9
	• Another person	18.9
	• Spouse	17.0
	Facilitating factor (activity):	
	• Class discussion	75.4
	• Class activities	66.0
	• Reading assignments	50.9
	• Group projects	35.8
	• Personal journal	34.0
	• Worksheets	34.0
	• Technology centre	26.4
	• Writing about concerns	26.4
	Facilitating factor (life change):	
	• Moving	39.6
	• Changing a job	32.1
	• Immigrating	28.3
	Facilitating factor (Internet exposure):	96.1
King, 2003a	Perspective transformation	70.6
	Facilitating factor:	
	• Reflection	100
	• Teaching experience itself	85.7

Using the incorporation of qualitative with quantitative methods previously reported (King, 1997b, 1999, 2000a), King (2002a, 2002e) conducted a thorough analysis of the substantial data. The participants identified people and learning activities as well as life change experiences as facilitators of perspective transformation (see Table 5) as reported in the survey instrument, journal entries, reflective essays, and follow-up interviews.

As a way of articulating the findings, King (2002a, 2002e) used a metaphor of a "journey of transformation" (King, 2002a, p. 161) and based seven chapters of her books (King, 2002a, 2003) on that metaphor. Although the moniker implies a progression of learning, King (2002a) argued that the teacher need not participate in every phase in order to experience perspective transformation. The journey of transformation was divided into four stages and corresponded to Mezirow's (1978a, 1978b) 10-phase model of perspective transformation (see Table 6) and "is one of fundamental transformations of perspectives, ways of understanding, and empowerment that goes beyond technology (the innovation) itself and is best explained through transformational learning theory" (King 2002e, p. 199). King

Table 6: *King's (2002a, 2002e) Journey of Transformation*

King's (2002a, 2002e) Stages	Mezirow's (1978a, 1978b) Phases	
Fear and Uncertainty	1.	A disorienting dilemma
	2.	Self-evaluation
	3.	A critical assessment of epistemic, socio-cultural or psychic assumptions
Testing and Exploring	4.	Recognition that one's discontent and the process of transformation are shared
	5.	Exploration of options for new roles, relationships, and actions
	6.	Planning a course of action
	7.	Acquisition of knowledge and skills for implementing one's plans
Affirming and Connecting	8.	Provisional trying of new roles
	9.	Building of competence and self-confidence in new roles and relationships
New Perspectives	10.	Reintegration of a new perspective into one's life

(2002e) argued that this metaphor could prove useful in describing the experiences of teachers' perspective transformations in future research studies. Inexplicably, there was a major weakness in King's (2002a) book as it did not include Mezirow's (1991a) revised 11-phase model but represented the 11 phases in the Learning Activities Survey – Professional Development in Technology questionnaire statements (see Appendix A).

As well, she reported that the teachers might experience six changes along the journey of transformation (King, 2002a): (1) emphasis on self-directed learning, (2) use of new teaching methods, (3) incorporation of critical thinking skill development in learning, (4) employing problem-based learning, (5) preparation and research, and (6) confidence and empowerment. The teachers do not necessarily experience these changes in sequential order nor do they have to experience all six changes in a given learning opportunity. For some teachers, the changes occur over a long period of time; however, exemplifying one change on the journey is evidence that a perspective transformation occurred for that teacher. The metaphor, the four stages of the journey, and the related six changes along the journey had implications for the data discussion in my study.

Not surprisingly, the metaphor was continued in her (King, 2003a) replicatory study of a convenience sample of 17 higher education "technology-savvy" faculty who were in public and private graduate schools of education. King (2003) stressed that the sample was drawn from academic listservs and research conferences and was therefore diversely representative of teaching experience and geographical location. It should also be noted that none of the professors were technology specialists in that they did not teach educational technology courses to undergraduate students but rather used, integrated, or taught technology skills (Kitchenham, 2003) in their content-specific university classrooms. The majority of the professors was female (76.5%), Caucasian (94.1%), between 50 and 59 years old (47%), and had an average number of teaching experience of 14 years (M = 14.06; range of 1 to 28 years). Using a further adaptation of the Learning Activities Survey – Professional Development in Technology questionnaire (King, 2002a, 2002e), the "Technology Impact Interview," King (2003) was able to use a "series of objective and free response questions to determine whether a respondent experienced a perspective transformation" (p. 201). The nature of the instrument was to ask participants if they had experienced any perspective transformation phases (Mezirow & Associates, 1990) in a checklist format, on which they ticked which statements applied, and then query any responses that required clarification or expansion; in addition, the interviewer could ask further questions based on the interviewee's comment. The initial data analysis encompassed two phases by firstly examining the qualitative data for emergent themes and by secondly coding the responses to ascertain a frequency count. After this stage was completed, the second phase involved further clarification from the respondents by conducting follow-up phone conversations or email messages.

King (2003a) found that 12 of the 17 (70.6%) professors experienced a perspective transformation. Unfortunately, King (2003a) did not include the demographic breakdown of the professors who experienced perspective transformations. Unlike the teachers and teachers-in-training in King's (2002a, 2002e) study, the professors reported that the prompts for the perspective transformation were reflection (n = 7 responses) and the teaching experience itself (n = 6 responses); in short, learning technology, per se, did not appear to prompt a perspective transformation as it did with the teachers and teachers-in-training vis-à-vis the curriculum project and lab experiences in her earlier study (King 2002a, 2002e) (see

Table 5). The professors did indicate that technology had changed their professional and educational practice; the six most frequently-cited changes were: (1) cultivation of critical thinking skills; (2) an increase in class discussions; (3) an increase in student-centeredness; (4) engaging students in constructivist learning; (5) becoming more organized; and (6) using computer and Internet resources in the classes. As part of the enquiry, King (2003) questioned the professors on their major modes of acquiring technology skills and discovered the following sources: self-study (82%), professional development workshops (70%), friends (65%), computer tutorials (59%), books (35%), colleagues (24%), spouse (24%), individual tutors (24%), student (24%), and another source (24%). King (2003) concluded with a salient implication for future research with professors and technology: "In faculty schedules that are already filled with research, writing, teaching, advising and committee work, the dilemma becomes where to find time and energy to pursue yet another avenue [of learning technology]" (p. 207). For elementary-school teachers, finding the time and energy to learn and practise educational technology skills is also a factor in their technology development (King, 2002a, 2002e; Kitchenham, 2003).

King's (2000a, 2002a, 2002e, 2003a) and LaCava's (2002) studies identified the presence of perspective transformations. What they omitted in their design and analysis of the data was the degree of perspective transformation. My present study identifies the degree of perspective transformation by extracting specific elements from the data and exemplifying those using the participants' comments.

Similar to King (2000a, 2002a, 2002e, 2003a), Whitelaw, Sears, and Campbell (2004) examined perspective transformation and educational technology with adult-learners. Using an action research paradigm, Whitelaw, Sears, and Campbell (2004) investigated the educational technology experiences of university lecturers and instructional designers within the “Partnership Program, a 5-year instructional development initiative of the Academic Technologies for Learning (ATL) unit at the University of Alberta” (p. 9) in Edmonton, Alberta, Canada. In particular, the researchers were interested in whether faculty members’ involvement in the Academic Technologies for Learning project and the related technology-enhanced learning environments would result in a perspective transformation. There were 48 participants who agreed to take part in the Partnership Program during which they completed instructional development projects and acquired educational technology skills and strategies by working intensively, as a collaborative partner, with an instructional designer and a technical production team who were experts in graphic design, webpage development, video creation, and distance delivery courses. All 48 participants were invited to complete a survey; however, only 16 (10 female and 6 male) agreed to complete the qualitative-quantitative survey on their experiences in the Academic Technologies for Learning project. Like my study, this was a qualitative-quantitative study. However, the qualitative component of the survey required open-ended explanations of the effectiveness of the Partnership Program and on the instructional design process. The quantitative component of the survey asked the respondents to answer a series of yes/no questions followed by a 5-point Likert scale on the usefulness of the technology support provided, on the factors that encouraged professional development, and on comfort levels with various technologies. Again, as I did, the researchers used NVivo to analyse the qualitative data. They used SPSS to analyse the quantitative data.

The researchers did not appear to ask suitable questions to ascertain the full range of perspective transformations as the questions seemed to be at a superficial level. For example, they asked the participants to discuss whether the Academic

Technologies for Learning project met the participants' expectations during the five-year Partnership Program at the University of Alberta. This lack of depth is further discussed below.

Demographically, the 16 participants were categorised into three age ranges: 30 to 39 years of age (n = 1), 40 to 49 years of age (n = 8), and older than 50 years of age (n = 7). They varied in academic rank: Full Professor (n = 4), Associate Professor (n = 8), Assistant Professor (n = 2), and graduate teaching assistant (n = 2). The demographics of age and rank were deemed, by the authors, as representative of ages and ranks in the professoriate at the University of Alberta.

Nine of the 16 participants participated in semi-structured interviews after the collection of survey data. All interviews were transcribed and were analysed by a group of researchers and research assistants for common themes. These data were analysed further by two researchers using Mezirow's (2000) four ways of learning: elaborating frames of reference, learning new frames of reference, transforming points of view, and transforming habits of mind. These results were then compared among the group of researchers and to the professional literature to ascertain any examples of transformative learning.

Whitelaw, Sears, and Campbell (2004) found that 2 of the 9 participants experienced a significant change in their beliefs and practice related to pedagogy and instructional technology. As a way of articulating their findings, Whitelaw, Sears, and Campbell (2004) identified three themes from the interview data and compared those themes with transformative learning: alignment/misalignment of expectations with experience, change in attitudes toward technology-enhanced instruction, and change in pedagogical style. They reported that the first theme appeared to be related to Mezirow's (1991a) disorienting dilemma and therefore would be a "possible opening to critical inquiry into one's own practice" (p. 18). The data within the second theme did not support a relationship between a change in attitudes toward technology-enhanced instruction and transformative learning. The third theme data suggested a possible relationship between change in pedagogy and transformative learning to the extent that the authors indicated a need for further studies that investigate the occurrence of transformations in practice (Whitelaw, Sears, & Campbell, 2004). My present study, which commenced earlier than Whitelaw, Sears, and Campbell's, (2004) publication, investigated exactly what the authors could only indicate: an occurrence and degree of perspective transformations in practitioners.

Whitelaw, Sears, and Campbell (2004) acknowledged that their priority in the research study was to evaluate the Partnership Program within the Academic Technologies for Learning (ATL) unit at the University of Alberta and the existence of perspective transformation was a lesser priority. Nevertheless, as indicated earlier, Whitelaw, Sears, and Campbell (2004) examined perspective transformations at a disappointing superficial level. There was no discussion of meaning schemes, points of view, habits of mind, frames of reference, and meaning perspectives—the essential elements of perspective transformations.

Benson, Guy, and Tallman (2001) investigated the experiences of four graduate students enrolled in two on-line library media courses and whether transformative learning theory explained the changes that occurred in the students' learning. At the beginning of the courses, the researchers requested that all students complete written statements on their expectations for the courses. At the end of each course, they conducted focus group interviews with all enrolled students. Using a case study design, Benson, Guy, and Tallman (2001) selected four of the school media-specialists who had taken one of the courses, Reference Materials, as their first on-line course, completed both of the on-line courses, and had fewer than two years of Internet experience prior to enrolling in the Reference Materials course. The four participants completed semi-structured, one-on-one interviews with the researchers. In addition, the researchers conducted a document analysis of the archived bulletin board messages and of the email messages between the instructor of the two courses and her students.

Benson, Guy, and Tallman (2001) analysed the data in two phases. The first phase involved a within-case analysis from each of the four participants while the second phase was a cross-case analysis of the data from all four participants. Germane to the present study, the data revealed that one of the four students, Barbara, experienced a perspective transformation. She reported changes in her daily life. In particular, Barbara outlined changes in her interactions (i) with peers as she was previously more apt to solve her own problems rather than rely on others for assistance, (ii) in teaching in the form of more collaboration with her students, and (iii) giving more empowerment to her students. She also indicated that the on-line experiences caused her to think more deeply about her learning processes and the way she taught others. Though valuable for the breadth of literature on transformative learning, Benson, Guy, and Tallman's (2001) study did not research the students' experiences in the media centres. This present study examined this context as well as the degree of perspective transformations and the related factors as teachers developed in their use, integration, and teaching of educational technology.

Like King (2000a, 2002a, 2002e, 2003a), Whitelaw, Sears, and Campbell (2004), and Benson, Guy, and Tallman (2001), LaCava (2002) conducted research on transformative learning and educational technology. LaCava's (2002) doctoral dissertation continued King's (2000b) research with English-as-a-second-language

(ESL) adult learners who experienced a perspective transformation when using Internet technology. The selected sample was 56 ESL learners (n = 56; 37 female and 19 male) in the ESL classes of a Connecticut vocational technical school. The students ranged in age from 19 to 50 years old (M = 33.8), had been in the United States for 2.5 weeks to 17 years, and came from Latino (n = 49), southeast Asian (n = 6), and European (n = 1) countries.

LaCava (2002) adapted King's (2000b) Learning Activities Survey: ESL format (LAS – ESL) by re-wording statements or adding questions regarding the use of Internet technology to the first three sections of the original instrument to create the Learning Activities Survey – ESL/Technology (LAS – ESL/T). LaCava (2002) met with each ESL instructor to ensure that the learning activities on the LAS – ESL/T applied to the ESL course, that the students would be able to understand the language used, and to discover to what extent Internet technology was used in their courses.

As previously stated (see "Transformative learning studies" in this chapter), the survey instrument yielded a perspective transformation index by assigning a "3" to those participants who reported a perspective transformation during their ESL education, a "2" for any kind of perspective transformation, and a "1" for a participant who experienced no perspective transformation. The students were invited to participate in an in-depth interview after completing the LAS – ESL/T; 7 of the 27 students who volunteered were randomly chosen and interviewed.

LaCava (2002) found that 94.6% (n = 53) of the participants experienced a perspective transformation by scoring a perspective transformation index of "3" on the LAS – ESL/T (see Table 5). She reported that the four main contributors to perspective transformation were: (a) learning activities (class discussions [75.4%], class activities [66.0%], reading assignments [50.9%], group projects [35.8%], personal journal [34.0%], worksheets [34.0%], technology centre [26.4%], writing about concerns [26.4], role plays [13.2%], and essays [13.2]), (b) influential people (the teacher [64.2%], a friend [50.9%], a student [18.9%], another person [18.9%], and a spouse [17.0%]), (c) significant life changes (moving [39.6%], changing a job [32.1%], and immigrating [28.3%]), and (d) Internet exposure (96.1%).

Four dominant factors emerged from the interviewees who had experienced a perspective transformation: (a) language learning, (b) cultural change, (c) personal change, and (d) Internet exposure. LaCava (2002) further subjected the data to quantitative analysis by performing a series of Pearson chi-square nonparametric tests on the demographical information and the presence or absence of perspective transformation. She reported that there was no statistically-significant difference between the demographic factors of age, gender, marital status, race, education, and time in the ESL program and the presence or absence of perspective transformation. LaCava (2002) concluded her dissertation with a recommendation that there was “a basic need for continued research on perspective transformation facilitators” (p. 122) as have other researchers, generally (Cranton, 1996; Cranton & King, 2003; Cranton & Roy, 2003; King, 1999; Mezirow, 2003; Taylor, 2000), and specifically in technology (King, 2002a, 2002e, 2003a, 2003b; LaCava, 2002). This present study also took up LaCava’s (2002) challenge.

Conclusion

Since Mezirow’s (1978a) original proposal that adult-learners experience phases as they acquire knowledge, the theory has undergone several revisions to include an emphasis on self-directed learning (Mezirow, 1985), the elaboration of learning types (Mezirow, 1985; see Figure 1), critical self-reflection (Mezirow, 1990; see Figure 2), and critical reflection of and on assumptions (Mezirow, 1998; see

Figure 3), the addition of another phase (Mezirow, 1991), the revised types of learning (Mezirow, 2000; see Figure 5) and a revised definition (Mezirow, 2003). The elements of transformative learning—meaning perspective, frame of reference, habits of mind, point of view, and meaning schemes (see Figure 4) —proved useful in describing perspective transformations and variations in perspective transformations of the 10 participants in this study; specifically, the participants used, integrated, and taught technology. These elements also lent support to the argument that transformative learning was a viable research framework for describing the teachers' development in technology use, integration, and teaching (Research Question 2). Figures 1 through 5 also bring a high degree of comprehension to the reader and graphically demonstrate the complexity of Mezirow's theoretical model of transformative learning.

As well, the adult-learning principles outlined in the numerous andragogical studies (see Table 4) provided a well-researched theoretical basis for the design of professional development for my study. To maximise success in the professional development action plans, the participants needed to feel a sense of empowerment (Cranton, 1994; King, 2002a; Lawler, 1991, 2003; Lawler & King, 2000, 2003; Merriam & Caffarella, 1999) by having input into what they wanted to learn based on what they already knew (Cranton, 1996; Lawler & King, 2000). A diversity of teaching methods was used (Apps, 1991; King, 2002a; Lawler, 1991, 2003; Lawler & King, 2000, 2003) to meet their technology goals, to address the people with whom they wanted to work or collaborate (King, 2002a; Lawler, 1991; Lawler & King, 2000, 2003), and to instil motivation by knowing that they alone were responsible for their own learning (King, 2002a; Lawler & King, 2000, 2003; Moran, 2001). Finally, the technology strategies and software needed to be practical and applicable to their daily teaching (Apps, 1991; Cranton, 1996; King, 2002a; Lawler & King, 2000, 2003; Moran, 2001).

King (2002a, 2002e, 2003) and LaCava (2002) have conducted studies on transformative learning and technology (see Table 5) relevant to my study. However, their dominant research methodologies were quantitative and did not appear to examine closely the elements of transformative learning. They were researching the presence of perspective transformations and what facilitating factors were evident but did not analyse their data for the presence of frames of reference, for example.

As well, Whitelaw, Sears, and Campbell (2004) and Benson, Guy, and Tallman (2001) conducted research on perspective transformation and educational technology. However, neither study examined perspective transformation in detail nor did they extract specific elements of perspective transformation as I did in this study.

My study examined not only the occurrence of perspective transformations but also the degree of perspective transformation (Research Question 1a) and the factors related to the perspective transformations (Research Question 1b). That is, the research design detected the variations in perspective transformation as well as the elements of transformative learning: meaning perspective, frame of reference, habits of mind, point of view, and meaning schemes. Transformative learning theory is composed of these elements and yet no study appears to have described the elements in depth. In short, there is a definite gap in the professional literature on transformative learning theory and educational technology; a gap that my study addressed.

CHAPTER 2

RESEARCH DESIGN

Transformative learning is a complex adult learning theory and involves many inter-related elements beyond the central perspective transformation (see Chapter 1). In order to examine the degree to which teachers experienced perspective transformations (Research Question 1a), the factors related to perspective transformations (Research Question 1b), and the viability of the theory as a defensible research framework to describe the 10 teachers' development in technology use, integration, and teaching (Research Question 2), the research design needed to be varied and complementary.

A mixed-methodology approach (Cresswell, 1995, 2003; Reichardt & Rallis, 1994; Tashakkori & Teddlie, 1998, 2003), combining qualitative and quantitative research methods, was appropriate for this study. The qualitative method allowed for the coding and categorisation of the rich responses from the 10 participants. The quantitative method allowed for the inclusion of frequency counts to describe the degree of perspective transformation and the number of factors related to perspective transformations as well as to detect any statistically-significant differences between the public and independent schools.

It was important to have a rich understanding of the backgrounds of the schools and of the 10 teachers so that a context for interpretation could be set. As argued by Hargreaves (1994, 2003), every school possesses a specific culture and regime (Hargreaves, 1994, 2003) which may or may not promote perspective transformations in educational technology so the interpretation of my research design was framed within that context. In addition, the demographic information about each teacher assisted in the data interpretation so that I could better categorise comments made by individual teachers when I considered their backgrounds (see "Transformative learner of technology" in Chapter 4).

The data collection methods in this study were varied and complementary. First, to set the context for the receptivity of educational technology in the three schools, the Technology Façade Checklist (Tomei, 2002) was administered to the three administrators so that they could comment on the technology use, the necessary infrastructure, and the instructional strategies presently used in the schools (see Appendices C, D, and E). Second, the 10 teachers were asked to complete professional development technology action plan forms to outline their technology goals, their strategies, their support systems, their start and end dates, and their indicators of success (see Appendix F). The action plans also served as a catalyst for change as the teachers were able to consult their plans and request any assistance from me via my interventions: workshops, email support, face-to-face communication, and telephone conversations. Third, the reflective journals allowed the teachers to record their thoughts and experiences about educational technology and thereby provided a rich source of perspective transformation data. Fourth, the Learning Activities Survey – Professional Development in Technology questionnaire acted as a brief but thorough assessment of the 11 transformative learning phases and of the factors related to perspective transformations (see "Transformative learning in practice" in Chapter 1 & Appendix A). Fifth, the semi-structured interviews permitted me to ask clarifying questions based on the journal entries, open-ended questionnaire responses, and comments made to me throughout the study (see Appendices G and H). Last, my field notes augmented the other sources and provided me the opportunity to record my own reflections on the teachers' perspective transformations (see Appendix I).

Overview

In this study, both qualitative and quantitative research methods were used in a mixed-methodology approach (Caracelli & Greene, 1993; Cresswell, 1995, 2003; Datta, 1994; Miles & Huberman, 1994; Reichardt & Rallis, 1994; Tashakkori & Teddlie, 1998, 2003). This methodology was appropriate to the present research study as it allowed me to extract the most powerful findings from the data through both description and quantification.

The research study demonstrates a purposeful commitment to a mixed-methodology approach as the data collection methods lent themselves well to capturing the rich language contained in the reflective journals, the questionnaire free-response section, and the semi-structured interview through qualitative methods. However, it was important to be able to report the degree of perspective transformation vis-à-vis the overall number of each Learning Activities Survey – Professional Development in Technology statement and transform those totals to thematic categories related to perspective transformation elements using a quantitative approach. As well, as this study is a doctoral thesis, it is crucial to support the research of others (e.g., King, 1999, 2000a, 2001, 2002a, 2002e, 2002f, 2003; LaCava, 2002) and, thereby, prove the credibility of my study.

Thus, the strategy of inquiry was 5 and transformative (Cresswell, 2003) as I collected data from sources one following the other (reflective journal, teacher questionnaire, and semi-structured interview) as well as data from three sources simultaneously (reflective journals, teacher questionnaire, and my research field notes). Figure 6 outlines the mixed-methodology research design on a twelve-month timeline.

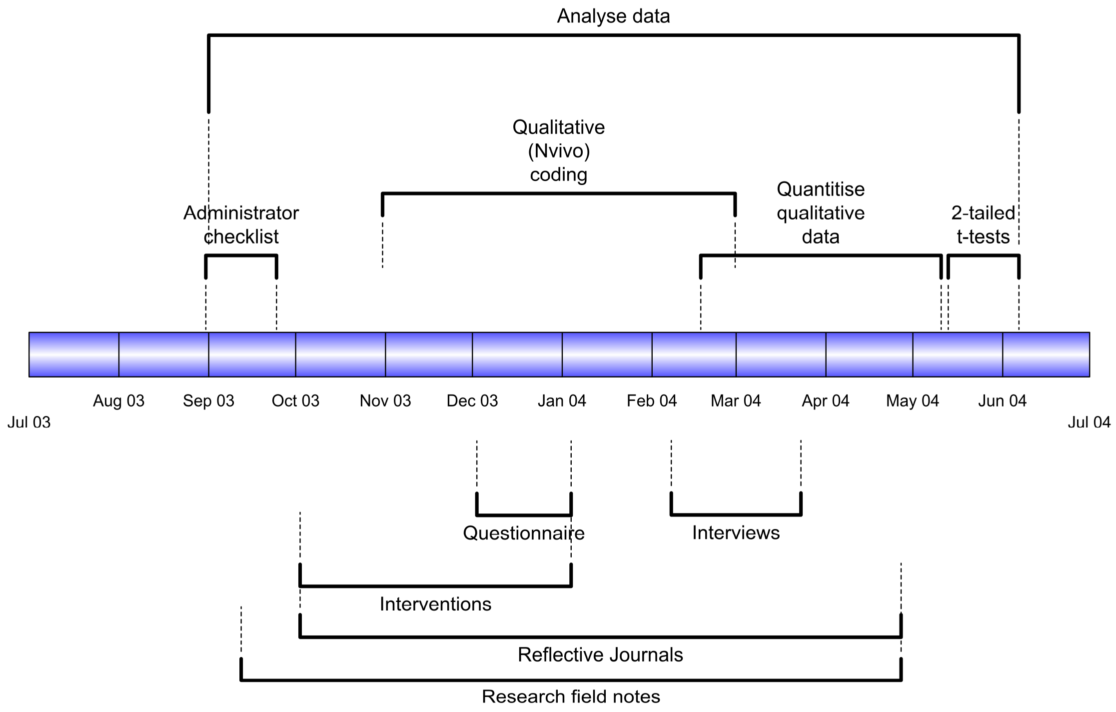


Figure 6: Mixed-methodology timeline of research methods used over a twelve-month period

The administrator questionnaire was completed within the first month of the study to set the educational technology context for each school and to allow the teachers the opportunity to familiarise themselves with their students in the first month of the school year, September (see Figure 6). As the teachers offered informal comments to me, I recorded field notes after the first two weeks of school and continued for approximately nine months (see Figure 6). The reflective journals were begun in the second month of the school year, October, since the teachers indicated that they felt comfortable recording their thoughts on educational technology at this time and they continued until May at which time the participants, on their volition, stopped recording journal entries (see Figure 6). It was a staggered stop over five weeks. The teacher questionnaire was administered during the first two weeks of December and the last two weeks of January to allow the teachers ample time to complete the questions without interfering with their holidays, the last two weeks of

December and first week of January (see Figure 6). The semi-structured interviews were conducted over a two-month period, mid-February to mid-April, as all the majority of data from the reflective journals, teacher questionnaire, and my field notes had been collected, all of which contributed to the semi-structured interview questions.

The requisite elements of transformative learning were outlined in Chapter 1 in which I also made the argument that transformative learning needed to focus on the whole experience rather than on the parts. In other words, to investigate perspective transformation, I needed to examine meaning schemes, for example, but could not interpret the information without discussing the meaning scheme within the larger context of transformative learning theory. The mixed-methodology approach allowed me to transform the qualitative data (Caracelli & Greene, 1993; Cresswell, 2003; Tashakkori & Teddlie, 1998) from the four sources, quantify them in the form of frequencies and rankings related to King's (2002a) Learning Activities Survey – Professional Development in Technology statements, and interpret the results within the theoretical construct of transformative learning.

To maximise credibility of data, the research aim and research questions required analysis from many perspectives (Cresswell, 2003) that explained how and when perspective transformations occurred. A mixed-methodology approach provided opportunities to explore the varied experiences of the 10 participants.

The study's research questions were to examine the factors that assisted or impeded teachers in educational technology within a transformative learning framework and to support or refute the argument that teachers' use, integration, and teaching of technology caused them to experience a perspective transformation. First-person accounts were essential to characterise the feelings of the individual participants. They were obtained through the reflective journal, teacher questionnaire, and semi-structured interview as well as through my informal research field notes (see Figure 6). This combination of research instruments that included closed- and open-ended responses (Tashakkori & Teddlie, 1998, 2003) allowed the opportunity to capture the subtle indicators of perspective transformation.

Participants’ accounts are obviously a requisite part of the investigation of perspective transformations. To this end I adopted a *sequential transformative* perspective for the research design which necessitated using a sound theoretical framework. Thus, my study was sequential as the data collection tools were implemented one after the other, with the exception of the field notes which spanned the whole data collection phase (see Figure 6). It was transformative because the aim of my study and the theoretical perspective adopted were more important in guiding the study than the use of the individual data collection methods (Cresswell, 2003).

As explored in detail in Chapter 1, the theoretical framework that I used for this study was transformative learning theory. Consistent with Cresswell’s (2003) conception of a defensible research design, I ensured that my two research questions drove the study and I utilised varied data collection methods which involved using qualitative and quantitative data in order to analyse and interpret the data (Cresswell, 2003). The mixed-methodology approach provided the insights necessary to investigate the social phenomenon of perspective transformations in the 10 participants of this research study.

The mixed-methodology approach adopted in this study allowed me to use the strengths of both qualitative and quantitative methodologies in order to “form an enduring partnership” (Reichardt & Rallis, 1994, p. 85) between the two approaches. The qualitative responses were rich in their nuances of language and expressions but did not overtly indicate the degree to which teachers experienced perspective transformations due to their development in the use, integration, and teaching of educational technology (Research Question 1a) nor did the qualitative approach yield an automatic counting of the number of times perspective transformation-related factors were highlighted by the teachers (Research Question 1b). Quantitative methods, in the form of frequencies of utterances as they related to the coded data, were recorded in raw score and then transformed into percentages. This allowed me to demonstrate the degree of perspective transformation experienced by the 10 teachers and record the number of times specific factors were discussed by the teachers. As well, two-tailed t-tests were performed in order to detect any statistically-significant differences between the public and independent schools. (The results were presented to the administrators at the end of the data collection phase.) This parametric test of significance between two correlated samples allowed me to ascertain differences in the number of perspective transformation-related utterances offered by School A, B, and C. A two-tailed t-test between School A (public) and School C (independent) and between School B (public) and School C (independent) was performed. Due to the short period of time I spent in the three schools, I was not confident that there would be statistically-significant differences between the public and independent schools so I interpreted the data using a two-tailed test of probability (Cates, 1985).

In these ways, the mixed-methodology approach provided the opportunity to "quantitize" (Miles & Huberman, 1994) the qualitative data as well as use a statistical analysis, a two-tailed t-test, to examine any difference in school type. The use of frequency counts also addressed the aim of the study as they allowed me to categorise and rank the factors that assisted and impeded teachers in educational technology within the transformative learning framework. As well, the frequency counts provided opportunities to qualify and quantify the data related to the degree perspective transformation experienced by the teachers through their use, integration, and teaching of educational technology.

Selection of the participants

School:

The choice of the three schools was selective and purposeful. I chose schools that were within a one-hour driving distance to ensure that I could arrive at the school to provide assistance when requested. To this end, I selected one urban elementary school (kindergarten to grade 7) from the Nanaimo School District (BC School District #69), one urban elementary school (kindergarten to grade 6) from the Cowichan Valley School District (BC School District #79), and one urban elementary school (kindergarten to grade 7) from the independent school system.

According to required protocol, I sent an email to the senior administrator of each school system and made a formal request to conduct research in the public or independent schools. The Superintendent of the two public school districts and the Head of the independent school replied with a message to directly contact the Principal or Junior Head of each school and receive permission from him or her. I contacted one school from each of the two public school districts and the Head of the Junior School for the independent school, explained the study, and received permission to conduct the study. Once written permission, vis-à-vis a letter from each administrator, was obtained, I sent another email to the superintendent of each school district. One superintendent gave formal permission at that point; the superintendent of the second school district delayed permission until a formal proposal was presented at the school district Ethics Committee monthly meeting. At the conclusion of that meeting, permission was granted to conduct the research study. The Head of the independent school agreed to the research study and assigned the Head of the Junior School as the liaison person.

Each administrator from the three schools was sent an email requesting assistance in recruiting four volunteer teachers for the study. Gender, number of years in teaching, and age were not criteria in choosing the participants. The sampling was purposeful as I wanted to ensure that cross-school-type (public versus independent) could be made. As an incentive, the teachers could use their work for course credit at Malaspina University-College. No teacher exercised this option.

Each administrator was asked to fill in a questionnaire on the school's informational technology use; had the administrator refused, another principal would have been asked. In sum, the final pooled sample from the three schools was 10 teachers (n = 10; two of the initial 12 teachers chose to withdraw from the study within the first two weeks for personal reasons). This small sample size (n = 10) was useful as "the issue is not so much the quest for conventional generalizability, but rather an understanding of the conditions under which a particular finding appears and operates: how, where, when, and why it carries as it does" (Huberman & Miles, 1998, pp. 204-205). In particular, the researcher was interested in meeting the research study's aims to examine the factors that assisted or impeded teachers in educational technology within a transformative learning framework and to support or refute the argument that teachers' use, integration, and teaching of technology caused them to experience a perspective transformation, rather than generalising to a broader population.

Teachers:

The teachers were selected using Morse's (1998) criteria for a "good informant" (p. 73) and "primary selection" (p. 74). That is, the teachers needed to have the requisite knowledge and experiences to participate in the study; the capability and opportunity to reflect on the issues related to the research questions; the time to record their observations; and the readiness to participate. If all four criteria were met, Morse labelled the process as “primary selection” (p. 74) and she argued that these good informants were excellent candidates for recording information and being interviewed. In order to address the criteria, I incorporated key statements into a proposal which was sent to the entire staff of the three schools with a request for four willing participants. A meeting was scheduled at each school so teachers could ask clarifying questions. At the conclusion of that meeting, four teachers from each school volunteered to participate in the study.

Consent:

At the outset of the study, consent forms (see Appendix B) were distributed to each teacher with an explanation of the study and the time commitment involved. In addition, the teachers were informed that their participation was voluntary, that they could withdraw at any point in the research study, that the results would not be used for evaluation or promotion purposes, that their names would not be used in the description of the results, and that they would be assigned a code in place of their names. Each consent form was signed and returned to me directly. Shortly after the commencement of the study, two teachers, one from School B and one from School C, withdrew for personal reasons as was their right according to the ethics principle outlined in the informed consent form. The data from those teachers were discarded and destroyed. The consent forms from the two teachers who withdrew were notated accordingly.

Description of the Schools

In order to understand the school context beyond observations of hearsay, I distributed an administrator questionnaire to each principal or head of school. Each administrator was given Tomei's (2002) standardised Technology Façade Checklist (see Appendices C, D, and E). According to Tomei (2002), this questionnaire had been used extensively by researchers and practitioners interested in technology use in schools.

The 20-item instrument asks a series of questions that deal with technology within the school and requires the administrators to assign a ranking according to how they measure the criterion, based on the three façade elements of: use of technology in a school (55 possible points), the necessary infrastructure (104 possible points), and viable instructional strategies (41 possible points). The overall score, which ranges from below 0 to 200 points, allows the school administrator to know the areas of strength and growth in educational technology. Key areas of examination are technology use, the prerequisite infrastructure, and realistic instructional strategies. This instrument creates a profile of the school's present level of technology diffusion according to the principal's perspective and allows comparison with the individual teacher's technology development. Due to the brief period of data collection, a post-administration of the Technology Façade Checklist was not conducted as it is doubtful that this research would change a large enough representation of the staff to affect the end-score.

Description of the Teachers

The demographic information was collected prior to the distribution of the questionnaire as an email attachment to each teacher. An indication of the age of the teacher (e.g., 30 – 39) and the number of years teaching (e.g., 6 – 10 years), and specific information on the teacher's gender, prior education, and the grade level taught were requested. The purpose of the general information was to ensure that I did not request facts that were too personal while the more specific information allowed me to infer information without directly asking a question that might be interpreted as offensive. For example, the fact that a teacher was between the age of 50 and 59 but had taught for 11 to 15 years implied that he or she had either entered the teaching profession at a late age or had taken a leave from teaching for an extended period of time.

As well, all participants knew me, knew of me, or knew of my reputation. The teachers were able to get past the authority figure persona as I knew six of them on a personal level, had taught one of them in university, and had worked with eight of them as they were sponsor teachers for my student teachers. I believe that I gained their respect very quickly because of those past experiences. That fact was reflected in the data collection and outcomes as I planned an initial meeting to see what they wanted to learn (e.g., A-1 indicated that this study was the first time that she felt that she had been given what she wanted); I provided just-in-time support (A-2, B-1, and C-1 commented on this support and its importance); I gave intervention choices and provided the type of interventions that was requested (A-4; B-2; & C-2 indicated that they found that helpful); I knew personal information about each participant that helped me in interpreting results (e.g., A-3 was experiencing problems in her personal life).

Data Collection

Adhering to Cranton's (1994) four stages of learner empowerment, the research design ensured that the study allowed many opportunities for empowerment as the teachers completed their professional development action plans; participated in workshops designed to address their specific needs and requests; reflected critically in their journals as well as when answering the questionnaire; and provided their thoughts during the semi-structured interviews. In addition, they were able to contact me for any assistance and received guidance within 24 hours of making the request. In short, following Cranton's (1994) four stages of learner empowerment (initial learner empowerment, learner critical self-reflection, transformative learning, and increased empowerment [i.e., autonomy]) allowed the second aim of this study to be met because it enabled the examination of the factors that assisted or impeded teachers implementing educational technology within a transformative learning framework. As well, King's (1997, 2000a, 2000b, 2002b) research findings and her design of the Learning Activities Survey (King, 1997a) helped maximise achieving the first part of Research Question 1 of this study as her research supported the argument that the teachers' use, integration, and teaching of technology caused them to experience a perspective transformation.

In addition, my research design attempted to address the professional development assumptions articulated by Lawler and King (2003; see Chapter 1). The professional development workshops were based on the adult-learning principles of empowerment, autonomy, and practicality (adult education) and were derived from the needs of the participants as articulated in their action plans (learner-centred). The questions of the study were directly related to transformative learning and the research instruments were designed to detect the occurrence of perspective transformations (transformative learning). One of the foci of the reflective journal entries was to articulate any concerns or frustrations with educational technology and I then used those comments for further workshops or one-on-one tutorials (motivation). Lastly, the aim and design of my study addressed the technology development of the participants (technology learning).

In order to assist the teachers in their employment of technology, I met with each school's participants (n = 10), outlined the general aims of the study, and how the research data would be collected (reflective journals, teacher questionnaire, semi-structured interview, and my field notes). The teachers were asked to keep reflective journals for four months that discussed their educational technology experiences in the classroom. The format for the journal was either on-going email or handwritten submissions. In addition, they agreed to complete a three-page questionnaire and to be interviewed at the conclusion of the study. Researcher field notes were kept before, during, and after any exchange with each participant.

In sum, data sources for this research study included: (a) the aforementioned Technology Façade Checklist, (b) the professional development action plan forms, (c) reflective journal entries, (d) a teacher questionnaire, (e) participant interview, and (e) my field notes. The combination of these data collection methods was unique to my study; however, each method had been used previously in transformative learning (King, 2002a, 2002e, 2003a, 2003b; LaCava, 2002; Whitelaw, Sears, & Campbell, 2004), andragogical (Cranton, 1994, 1996, 2001; Kitchenham, 2001a, 2001b, 2001c, 2003), and/or educational technology studies (Kitchenham, 2001a, 2001b, 2001c, 2003; Tomei, 2002).

Professional Development model

Rossett, Douglis, and Frazee (2003) presented a blended learning model that appeared to work particularly well for the professional development of the 10 teachers in my study as it incorporated the adult-learning principles outlined in the previous chapter (see "Adult-learning principles," Chapter 1). They argued that the facilitator had to remain focussed on the strategy so that the participants could see how to combine resources to maximize their success in achieving their learning goals. In this way, the facilitator was utilizing diverse teaching methods, modelling immediate application, and providing practice-based activities. As the 10 teachers did not always know when they needed additional assistance or even when they should have implemented their new skills, I needed to provide guidance in the form of templates, examples, tests, and models and allow the teachers to choose what they found useful (Rossett, Douglis, & Frazee, 2003). This presentation of deliverable assets encouraged the teachers to have a critical attitude as they knew which assets would be most deliverable in their respective classrooms. By working cross-functionally, all participants understood their individual roles in the implementation of their newly-acquired skills (Rossett, Douglis, & Frazee, 2003). Given that teachers tend to be social, the adult-learning principle of group and cooperative learning would be a natural choice for working cross-functionally. When working with teachers and blended learning, I encouraged independence and conviviality by presenting myriad methods from printed materials to email to discussion groups (Rossett, Douglis, & Frazee, 2003). This multi-faceted approach also created empowerment among the teachers. It was critical to focus on flexible options for learning so that the teachers could receive synchronous and asynchronous information when it was convenient for them rather than waiting for an expert to provide an answer (Rossett, Douglis, & Frazee, 2003). This blended learning factor created a climate of respect as the teachers felt that I understood better the demands on their time. By putting the teachers in the middle of the blend they were likely to participate more actively and be more motivated because they perceived that I saw them as the centre of the learning process (Rossett, Douglis, & Frazee, 2003). As the professional development facilitator, I needed to communicate the connections between and among learning options so that the teachers could overtly see the choices presented to them. In this way, I declared assumptions about learning and the payoff for that learning. By presenting information from a variety of perspectives and through a variety of overlapping methods, the teachers could embrace redundancy and build on their past experiences (Rossett, Douglis, & Frazee, 2003). This approach created a genuine feedback loop and encouraged self-directed learning among the participants.

As well, Herrington's (Herrington & Herrington, 2004; Herrington & Oliver, 2000) research on situated learning, particular to professional development, influenced the professional development model for my study as the research was grounded in the theory of authentic learning environments. This notion worked well with transformative learning theory as both theories emphasise critical discourse in a community of practice (Herrington & Herrington, 2004; Mezirow, 2000).

After conducting a meta-analysis of the situated learning literature, Herrington and Oliver (2000) purported that there were nine characteristics of authentic learning environments: (1) authentic contexts; (2) authentic activities; (3) access to expert performances; (4) multiple roles and perspectives; (5) collaborative construction of knowledge; (6) opportunities for reflection; (7) opportunities for articulation; (8) coaching and scaffolding; and (9) authentic assessment of learning. I attempted to incorporate each of these nine characteristics in my professional development design. The teachers were interested in knowing how the educational technology strategies that they learned would be useful in their real-life classrooms (i.e., authentic contexts) and that the professional development activities would be ill-defined enough to allow for their own thinking in relation to their respective students (i.e., authentic activities). They needed to have access to me, as the facilitator, and to other models of practice so that they could request and get assistance when needed (i.e., access to expert performances and coaching and scaffolding). Through the use of case studies, face-to-face workshop discussions, and across-participant email exchanges, the 10 teachers were provided with opportunities to challenge or accept others' opinions (i.e., multiple roles and perspectives) and to express their own opinions (i.e., opportunities for articulation). I ensured that there was the potential for working with other teachers by requesting that the 10 teachers record a person or persons with whom they would work in order to complete their professional development action plans. As will be discussed later in this chapter, the 10 teachers were able to articulate their own goals for professional development and to reflect on their learning in their respective journals (i.e., opportunities for reflection). Lastly, I recorded which teachers were able to attain their professional development goals and which were unsuccessful in completing their goals (i.e., authentic assessment).

By considering the well-regarded and well-cited research of Rossett, Douglis, and Frazee (2003) and Herrington (Herrington & Herrington, 2004; Herrington & Oliver, 2000), I ensured that the reliability of the professional development model in my study was maximised.

Professional Development action plans

Each teacher was asked to complete a technology professional growth action plan. This form had been utilised in my previous research (Kitchenham, 2001a, 2001b, 2001c, 2003) and proved reliable in its simple but effective design. The form allowed the teachers to include what they wanted to accomplish by having delineated sections (see Appendix F for a sample action plan): what they defined as their goal ("Objective or Goal for Integration of Technology Project:"), the methods for accomplishing their goal ("Strategies" and "Staff Development") the start and end date (“Target Dates: Start and Finish”), what was needed or who assisted the teacher (“Needed Resources” and “Person(s) Responsible”), and what was the proof of its success (“Evaluators and Indicators of Success”).

One month later, based on what the teachers had listed in their action plans, one of three actions were to be taken: (a) workshops for those teachers who decided on a technology tool (e.g., making webpages with Microsoft FrontPage or Dreamweaver MX); (b) one-on-one tutorials for those teachers who decided that they needed a private lesson or lessons in order to awaken latent technology skills or to assist in planning specific lesson plans; or (c) model lessons for those teachers who believed that they needed to see me demonstrate how technology could be used, integrated, or taught to a group of 15 to 28 students. I offered to teach one to three model lessons for each participant who requested that option. An audiotaped debriefing of the model lessons and invited observations would follow delivery. Each teacher could be involved in one, two, or three of the aforementioned scenarios.

Reflective journal writing

Each teacher was requested to keep a reflective journal for four of the seven-month duration of the research study. The journal was meant to act as a “fulcrum for professional development [that] would bring order to a turbulent environment [and act] as a basis for building a better world” (Ghaye & Ghaye, 1998, p. 83). The foci of the specific entries were threefold: (1) to express their feelings and experiences with technology, in general, and on the workshops and tutorials, in particular; (2) to discuss the implementation of their action plan; and (3) to ask questions of me so that I could answer them via either email or arrange for a face-to-face meeting at a later date. The journal entries were maintained from the second month of the school year, October, to the penultimate month, May, of the school year.

Teacher questionnaire

The teacher questionnaire was adapted from King's (2002a, 2002e, 2003) Learning Activities Survey – Professional Development Technology Format (LAS – PD TECH) and surveyed not only the experiences of the participants but also what factors were present to assist or deter teachers from technology development. In terms of design, King's questionnaire was slightly modified to be more suitable for this research study (see Table 7) as (1) the "Introduction" wording in the original questionnaire was too nebulous ("This survey helps explore") or too leading ("Two

Table 7: *Modifications to the LAS – PD TECH (King 2002a, 2002e, 2003) for the present study*

Original		Modification
Introduction	"This survey helps explore"	Replaced with: "The purpose of"
Introduction	"Two aspects of these experiences are examined: first, how does the teacher's perspective about technology and teaching change, and second, what contributed to this change?"	Deleted
Question 6 & 7	"a class assignment"	Replaced with: "research project"
Question 6 & 7	"course"	Deleted
Question 6 & 7	"Presenting to class"	Replaced with: "Action plan"
Question 6 & 7	"project"	Deleted
Question 6 & 7	"Self-evaluation in a course"	Replaced with: "Student teacher"
Question 6 & 7	"Term paper/essay"	Deleted
Question 6	"Class presentation by another"	Deleted
Question 6 & 7	"classmate's"	Replaced with: "participant's"
Question 6 & 7	"teacher's"	Replaced with: "researcher's"
Demographic information		Deleted

aspects of these experiences are examined: first, how does the teacher's perspective about technology and teaching change, and second, what contributed to this change?”), (2) the teachers in my study did not participate in the same activities as did King’s, and (3) the demographic information section of the original questionnaire had already been collected by me in an earlier phase of the study.

Permission was granted for adapting the final survey instrument (K. King, personal communication, January 18, 2004). Prior to the final distribution, the questionnaire was sent to two researchers familiar with transformative learning (P. Cranton, personal communication, January 9, 2004; K. King, personal communication, January 18, 2004). The rationale for sending the questionnaire was to have input from one researcher who understood the transformative learning and the instrument (King) and one who understood transformative learning and the Canadian context (Cranton). My and their suggested changes included expanding the preamble to explain the questionnaire, re-wording questions six and seven for clarity, and to be aligned with the interventions of my study. All suggested changes were incorporated into the final instrument (see Table 7 and Appendix A). The questionnaire was administered during the first two weeks of December and the first week of January (see Figure 6) in order to maximise completion by not interrupting their holidays which were the last two weeks of December to the first week of January, inclusive.

Seven of the 10 teachers expressed some frustration at the statements listed in Question Three as they found them to be difficult to understand. I did provide a preamble after the first questionnaire was returned and it assisted that teacher and the remaining nine to understand. Additionally, during the face-to-face interview, two teachers, A – 3 and C – 3, reported that, upon reflection, they would have answered in the affirmative the initial question on the Learning Activities Survey – Professional Development in Technology questionnaire (“Since you have been learning about technology, do you believe you have experienced a change in your teaching because of learning about and using technology?") had they had a better understanding of the initial question (see "Recommendations for Future Research" in Chapter 5).

The semi-structured interview

The audiotaped participant interview was a semi-structured interview with guiding questions (see Appendix G) and was conducted at the conclusion of the study or five months after the initial workshop. It was important to interview the participants at the conclusion of the study so that I could augment the reflective journal and questionnaire data by asking questions specific to each participant, based on what their own comments had revealed about their perspective transformations. For instance, a teacher could record a journal entry about how the technology was expensive and time consuming but not elaborate on that belief. The interview guiding question allowed me to draw out further details about why the teacher felt technology was expensive and time consuming. At the beginning of the semi-structured interview, the participants were informed that they were permitted to take as long as they wanted to answer the questions and to contribute responses that were not necessarily related to the interview questions.

The media used for capturing the digital audio files was proprietary to the digital recorder, an Olympus DM – 10. A Sony ECM flat microphone increased the quality of the recording due to its feature of recording in a variety of physical environments such as the teacher preparation room, the teacher classroom, and the principal's office.

The interview questions were framed by the 11 phases adults experience in perspective transformation, identified by Mezirow (1978a, 1978b, 1998), and represented in King's (2002, 2003) Learning Activities Survey – Professional Development in Technology. The questions were also specifically linked to the reflective journal entries, questionnaire responses, questionnaire comments, and my field notes. In other words, I compiled the interview questions by analysing the comments and responses from each source and formulating questions of clarification and expansion. In essence, each schedule of 15 questions was unique to the individual participant (see Appendix G for a sample schedule). However, there was also commonality (see Appendix G for a sample schedule) in eight questions.

Sample questions specific to individuals included, but were not limited to: “You indicated in your journal that a student teacher has influenced you in your technology beliefs. Please expand on that entry”; “You told me that you did not see the use of PowerPoint in the primary classroom. Can you tell me why?”; and “Why are you frustrated with the lack of technology support from the present administration?” Of the 15 questions, common interrogatives included, but were not limited to: “What factors assisted you in succeeding in your action plan?”; “What factors deterred you?”; “What is an example of something that helped you change your view on technology?”; “Compare the present administration’s support in technology with the past administrator’s support”; “The theoretical framework I am using in this study is Transformative Learning which is based on the three key principles of adult learning: (1) autonomy; (2) empowerment; and (3) collaboration. In your opinion, is this framework viable for teachers’ development in technology?” followed by “Can you elaborate, please?” This instance was the first time the transformative learning was directly mentioned to the interviewees. The participants also had an opportunity to elaborate areas of concern specific to educational technology that were not asked by me.

Eight of the 10 interviews were transcribed by me using a foot pedal which was compatible with the transcription module of the Olympus DSS Player 2000 software; two were transcribed by a support staff member and then checked by me for accuracy. The typed transcriptions ranged in length from 11 to 32, 1.5 line-spaced, pages; the average length was 19 pages, and the total amount of transcription was 193 pages (see Appendix H for a sample transcription). Prior to my data analysis of the transcriptions, they were sent to the respective participants for feedback. All 10 teachers indicated that the transcriptions were an accurate representation of the interviews and no revisions or clarifications were needed.

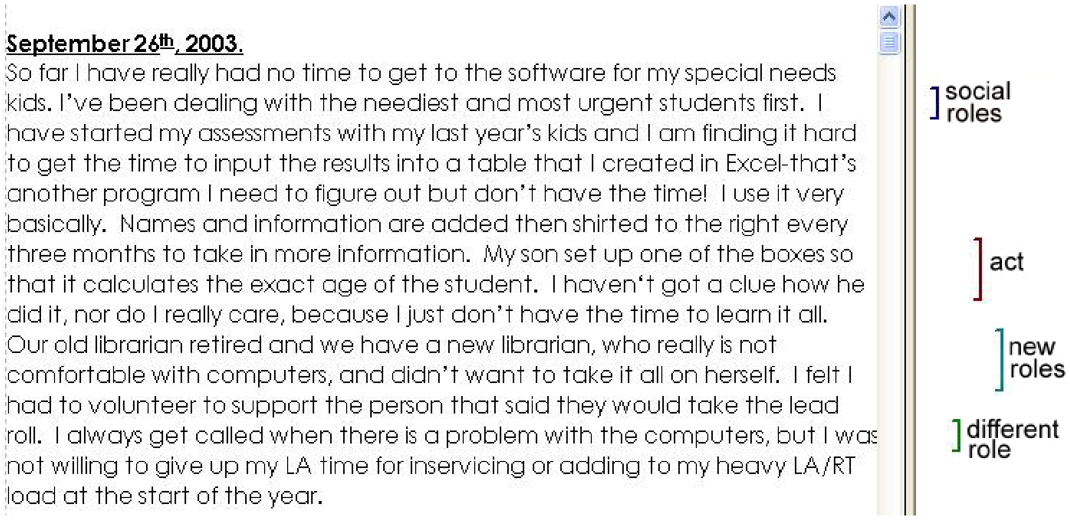
My field notes

My field notes were a valuable addition to these sources of data as they provided opportunities for extended informal conversations between me and the participants and among the participants themselves in my presence (Clandinin & Connelly, 2004; Stringer, 2004), they documented my interactions to support my earlier claim that I did not unduly influence the participants' perspective transformations (Glesne, 1999), and they served as a weekly record for me over the course of seven months (Shank, 2002). Using the dictation module of the Olympus digital recorder, I audiotaped questions from the participants and comments made during informal discussions, my own observations of a participant's professional development work vis-à-vis finished products, debriefing notes from individual and group meetings, and my own reflections of areas for future discussion. In addition, I audiotaped telephone conversations using a speaker phone at home and at my university office. All audiotaped comments, like the interviews, were transcribed by me throughout the study using Microsoft Word (see Appendix I for a sample transcription). Email messages were also cut and pasted into Word documents (see Appendix J for a sample email message exchange).

Coding and Categorising

Each of the four sources of mixed-methodology data (Caracelli & Greene, 1993; Cresswell, 1995, 2003; Datta, 1994; Miles & Huberman, 1994; Reichardt & Rallis, 1994; Tashakkori & Teddlie, 1998, 2003) were subjected to a constant comparative method within the multi-stage research model (Cresswell, 1998; Gall, Borg, & Gall, 1996; Hodson, 1991; Huberman & Miles, 1998; King 2002a, 2003; Moustakas, 1994). Thus, as each source of data was received, the coding and categorising were compared with any existing data. For example, when a reflective journal entry was emailed, I compared my coding of it with that of other journal entries from the same participant, with other journal entries from other participants, with the Learning Activities Survey – Professional Development in Technology questionnaire, interview, and field notes data from that participant, and with the Learning Activities Survey – Professional Development in Technology questionnaire, interview, and field notes data from the other participants.

All written data were entered into NVivo and analysed using the speed coding bar and the coder (see Figure 7). The speed coding bar allowed me a great deal of flexibility in coding the data. For instance, I could highlight a word (e.g., “megalomaniacal”), a phrase (e.g., “he just pushed me and pushed me”), or a sentence (e.g., “I just wanted to scream at him that I needed to learn how to do it by myself”). I could then assign a coded term, or a node, to the highlighted words. Each node, or a concept to which I wished to refer (Richards, 1999a), was then categorized into indigenous typologies (Patton, 1987; see Table 8) using the 11 phases of perspective transformation (King, 2001, 2002a, 2002e, 2003) or my analyst-constructed typologies (Patton, 1987) to characterise the factors that were related to perspective transformations.



September 26th, 2003.
So far I have really had no time to get to the software for my special needs kids. I've been dealing with the neediest and most urgent students first. I have started my assessments with my last year's kids and I am finding it hard to get the time to input the results into a table that I created in Excel-that's another program I need to figure out but don't have the time! I use it very basically. Names and information are added then shirted to the right every three months to take in more information. My son set up one of the boxes so that it calculates the exact age of the student. I haven't got a clue how he did it, nor do I really care, because I just don't have the time to learn it all. Our old librarian retired and we have a new librarian, who really is not comfortable with computers, and didn't want to take it all on herself. I felt I had to volunteer to support the person that said they would take the lead roll. I always get called when there is a problem with the computers, but I was not willing to give up my LA time for inservicing or adding to my heavy LA/RT load at the start of the year.

Figure 7. An example of an NVivo-coded document using the coding stripes feature

Table 8 lists the indigenous NVivo codes used and the corresponding statements from the Learning Activities Survey – Professional Development in Technology questionnaire (see Figure 7 for examples). I chose to use King's (2001,

Table 8: *Summary of NVivo codes used and the related indigenous typologies*

NVivo Codes	Indigenous Typologies
Act	I had an experience that caused me to question the way I usually act.
Social roles	I had an experience that caused me to question my ideas about social roles.
Disagree	As I questioned my ideas, I realized I no longer agreed with my previous beliefs or role expectations.
Others	I realized that other people also questioned their beliefs.
Different	I thought about acting in a different way from my usual beliefs and roles.
Traditional	I felt uncomfortable with traditional social expectations of teachers.
New roles	I tried out new roles so that I would become more comfortable or confident in them.
Adopt	I tried to figure out a way to adopt these new ways of acting.
Gather	I gathered the information I needed to adopt these new ways of acting.
Reaction	I began to think about the reactions and feedback from my new behaviour.
Action	I took action and adopted these new ways of acting.

2002a, 2002e, 2003) 11 statements as they corresponded to Mezirow's (1978a, 1978b) transformative learning phases but King used statements that would be easier to understand when articulating the data findings due to the simplicity of the language.

The factors related to the perspective transformation were categorised into seven analyst-constructed typologies (Patton, 1987): collaboration, administrator support, practice time, targeted funding, gauleiter, infrastructure, and administrator pressure (see Table 23 in Chapter 4). My previous studies (Kitchenham, 2002a, 2002b, 2003) and the research of King (2001, 2002a, 2003) and LaCava (2002) assisted in constructing four of these categories. That is, my own research (Kitchenham, 2002a, 2002b, 2003) revealed that administrator support and administrator pressure could influence teachers in the amount of educational technology they are willing to learn as they believe that if a principal is willing to support them, they will spend more time learning the technology but if the administrator pushes them into learning technology, they tend to resist. King (2001, 2002a, 2003) and LaCava (2002) argued that collaboration with other colleagues and the time to practice new skills could lead to perspective transformations. Three of the seven (gauleiter, targeted funding, and infrastructure) were original to this study, as they derived from the data.

The Learning Activities Survey – Professional Development in Technology statements were categorised into five dominant themes with respect to transformative learning elements (see Table 22 and Figure 8, Chapter 4): disorienting dilemma, altered sets of meaning schemes and perspectives, revised frame of reference, types of learning and processes, and critical reflection. These five themes were divided further into 24 sub-themes (see Figure 8 in Chapter 4). These themes and sub-themes represented the degree of perspective transformation experienced by the 10 participants and were original to my study as previous researchers (e.g., King, 2002a; LaCava, 2002) had not analysed and presented their research findings in as much depth as has occurred in this study.

Reflective journal writing

All of the participants had experience in reflective journal writing prior to my study as it was a well-established methodology from previous studies in which they had taken part. As well, some had been required to keep reflective journals in other aspects of their working lives. However, any teachers who expressed concern were shown sample journal entries. They were given much choice in the format of the journal (e.g., email submissions; Word attachments; and/or handwritten entries) which appeared to accommodate varied learning preferences.

The reflective journal writing submissions were analysed on a submission-by-submission basis as the research study progressed. When I received an email attachment, the document was saved as rich text format (RTF) to ensure compatibility with the qualitative research software, NVivo, and then entered into NVivo’s document window and coded accordingly. If the submission was not an email attachment and was sent as a handwritten document or contained within an email message, it was typed or cut and pasted into Microsoft Word XP, respectively, saved as a rich text format, loaded into NVivo and coded. The files were saved by teacher name, (A – 1 to A – 4; B – 1 to B – 3; C – 1 to C – 3) and were augmented as more entries were sent to me.

Those entries that were not transformative-learning-based were discarded as the primary emphasis of the research study was to detect any perspective transformations and factors related to these transformations. For example, if a participant described an experience within a non-related thematic construct (e.g., “my children come home with their laundry" [A – 4]; "went on a field trip" [B – 1]; "I'd like to do my Masters in Counselling" [C – 2]), it was rejected.

If an entry was clearly related to a perspective transformation (e.g., "I thought, 'You're not going to tell me what to do. I'm going to do it my own way'"[C – 1] [Analyst-constructed typology: Gauleiter]; "Like, if I say to her, that we really need this, she'll get it for me. Because she knows that I'll use it" [B – 1] [Analyst-constructed typology: Administrator support]; "I knew I could learn more from him" [A – 1] [Indigenous typology: Gather]; see Table 8), it was coded using either one of the indigenous descriptors for the elements of a perspective transformation or one of the seven analyst-constructed typologies for the factors.

As the number of entries increased, they were added to the existing indigenous and analyst-constructed categories or new analyst-constructed nodes were created. For instance, initially many comments were related to the analyst-constructed nodes, collaboration, administrator support, and administrator pressure. As the study progressed, new analyst-constructed nodes (gauleiter, targeted funding, practice time, and infrastructure) were created.

Using the coding stripes in the document and node browsers, I was able to see how frequently a particular code occurred (see Figure 7). This NVivo feature allowed me to open a window that showed the nodes used in the coded document with brackets lined up with the sentence or phrase containing the code (Richards, 1999b). At a glance, I could view not only the specific node but also which nodes occurred most frequently within a coded document and therefore create a frequency count of the nodes.

Ultimately this frequency would be quantified so that a percentage for each category, by teacher, by school, and by type of school could be reported. For example, if a large percentage of the journal entries occurred in “social roles” and “gather” while few were coded as “reaction” (see Table 8), then it was hypothesised that perspective transformations tended to be related to how participants viewed their social roles as technology users, integrators, or teachers or how they gathered the information needed for such roles rather than thinking about the reactions and feedback from others based on the participants’ new behaviour. It should be stressed that these data were analysed as qualitative rather than quantitative phenomena; therefore, no comparative statistical analysis was conducted. The purpose of percentage frequencies was to “quantitize” (Miles & Huberman, 1994) the qualitative data so that a rank order for each data source could be created and thereby indicate which of the 11 transformative learning phases was the most to least critical in the perspective transformations of the 10 participants.

Teacher questionnaire

The teacher questionnaire (see Appendix A) was analysed by examining the 11 transformative learning elements (represented in Question 3 of the Learning Activities Survey – Professional Development in Technology) and factors (represented in Questions 6 and 7) that contributed to each teacher’s perspective transformation. Each “ticked” response to a questionnaire item indicated that the specific statement or factor was important for the teacher’s perspective transformation. The assumption was that the more times the statement or factor was chosen by participants, the greater degree that it contributed to a perspective transformation. However, if only one of the 11 statements was chosen, the teacher was still deemed as experiencing a perspective transformation in relation to the concept expressed in the statement. For example, eight respondents chose, “I tried out new roles so that I would become more comfortable or confident in them”, so I concluded that the statement probably was a major contributor to a perspective transformation whereas only two respondents chose, “I felt uncomfortable with traditional expectations of teachers” which led me to conclude that the comfort level with traditional social expectations of teachers was contributed minorly to the perspective transformations of all the participants.

Each of the 11 statements were placed in a tabular format and, beside the teachers’ coded names, a check mark was placed to indicate that they reported that they had experienced that particular change in relation to technology (see Table 15 in the next chapter). In addition, the questionnaire allowed for anecdotal comments; these responses were analysed in the same manner as that described for the journal entries and the transcribed interviews sections. For comparative purposes, the responses were further divided by school (A, B, and C) and by school type (public or independent).

The teacher questionnaire responses not only provided support for the existence of perspective transformations by the 10 participants, vis-à-vis the 11 Learning Activities Survey – Professional Development in Technology statements and contributing factors, but also comparative data related to school context and type and clarifying and elaboration questions for the subsequent semi-structured interviews.

The semi-structured interview

The transcriptions of the semi-structured interviews proved to be a strong bridge between the reflective journal entries and the teacher questionnaire. That is, the interview allowed me to ask pointed questions, based on what each teacher had recorded in their individual journals and on which statements or factors had been chosen on the teacher questionnaire. The sheer volume of transcribed interview data provided an abundant as well as rich source for answering the two research questions. This source was also very critical as the subtlety of a perspective transformation was often overlooked by the teacher but was quite evident in the comments made during the interview. For example, one teacher unknowingly demonstrated instrumental learning as she described the steps to learning Microsoft PowerPoint ("I started by opening PowerPoint and selecting a new page. I picked a format and gave it a title, 'Let's Learn About the Coldest Places on Earth'. I was able to change the background colour, add clip art and change the font. It looked great" [A – 2 interview]) but was not aware that she was describing a perspective transformation element (see "Individual themes of Perspective Transformation: Instrumental learning" in Chapter 4).

All of the transcribed interviews were entered into NVivo and analysed using the 11 indigenous codes to ascertain any perspective transformations. No new indigenous typologies were added as the existing 11 codes were robust and reliable. As well, the factors related to the perspective transformation were extracted and coded with the analyst-constructed typologies. In addition, the proprietary audio files were converted to wave (.wav) files so that the document link feature in NVivo could be utilised. That is, hearing an excerpt from the interview and seeing the words simultaneously allowed me to see patterns that might have been missed with only one medium.

My field notes

My field notes were my written and audiotaped comments and served two purposes. The first was to "capture a word-picture of the setting, the people, actions, and conversations as observed" (Bogdan & Biklin, 1992, p. 108) and was descriptive in nature. For example, one teacher commented that she understood the potential that the students could reach with effective technology instruction but became "angry that [she] could never do it until the administration respected [them] as teachers of technology" (C – 1). This statement caused me to hypothesise that the particular teacher might be experiencing a disorienting dilemma. This disorientation was supported by her subsequent conflicting statements offered to me throughout the study. The second purpose was much more reflective and was meant to represent my thought process in relation to specific comments from the participants. For example, the aforementioned teacher, C – 1, mentioned on eight occasions that one of the reasons she was so adamant to integrate technology was to prove to her administrator that she was valuable. I concluded that, for this teacher, administrator support and acknowledgement (King, 2002a; Kitchenham, 2003) were important contributing factors to her perspective transformation.

I used the information from my field notes to not only extract patterns from within the source but also to complement the other three data sources. For instance, I found evidence for the contributing factor of a person who is overbearing, authoritative, and megalomaniacal —a gauleiter—in my field notes as two participants described such a person. I then examined the reflective journal entries, the open-ended teacher questionnaire comments, and the interview responses for corroborating quotes from the participants. Similar to the reflective journal entries, the anecdotal comments included on the teacher questionnaire, and the semi-structured interview transcriptions, the field notes were coded for evidence of perspective transformations using the 11 Learning Activities Survey – Professional Development in Technology indigenous typologies and for factors related to the change. As well, the proprietary field notes audio files were converted to wave (wav.) files and the document link feature in NVivo was utilised to assist in interpretation.

In sum, each of the four sources of data addressed specific aspects of the two central research questions so that, considered together, they provided evidence for perspective transformation occurrence among the 10 participants (Research Question 1a), outlined factors that contributed to perspective transformation (Research Question 1b), and substantiated the claim that transformative learning was a viable research framework to describe the technology development of the 10 teachers in this study (Research Question 2).

Pooled data

By the conclusion of the study, all written data (journal entries; questionnaire comments; transcribed interviews; transcribed field notes) that were entered into the qualitative research software program (NVivo) were categorised by school: School A, School B, and School C. Further, School A and School B were combined and compared with School C to ascertain any qualitative differences between school type: public or independent. Lastly, quantitative comparisons, using two-tailed t-tests, were performed to demonstrate statistically-significant differences between School A (public) and School C (independent) and School B (public) and School C (independent). These data led to interesting trends in school context and regime (Hargreaves, 2003) which will be discussed in the next chapter.

Conclusion

To assist the reader in understanding better the rationale for a mixed-methodology approach (Caracelli & Greene, 1993; Cresswell, 1995, 2003; Datta, 1994; Miles & Huberman, 1994; Reichardt & Rallis, 1994; Tashakkori & Teddlie, 1998, 2003) adopted in this study, it was necessary to provide a rationale for the approach. The mixed-methodology approach best addressed the research aim and questions because it allowed the use of both qualitative and quantitative methods to collect the data. Using qualitative methods, I was able to code and categorise each data source into 11 indigenous typologies (Patton, 1987) for evidence of perspective transformations and into seven analyst-constructed typologies (Patton, 1987) for the presence of perspective transformation-related factors. The quantitative methods, frequency percentages and two-tailed t-tests, permitted me to rank the percentages to theorise which elements and factors of transformative learning were important in perspective transformations and to report statistically-significance differences between the public and independent schools, respectively.

The background information on the schools and teachers was important to collect so that the context of the study could be outlined. The setting for the study had to be natural, and therefore, authentic, for the teachers (Rossman & Rallis, 1998); therefore, it was important to understand the school culture and the school regime (Hargreaves, 2003) and to deliver *in situ* workshops. In this manner, I could "develop a high level of detail about the individual or place and be highly involved in the actual experiences of the participants" (Cresswell, 2003, p. 181). I came to know all 10 participants quite well as I taught them, observed them, and received thoughtful comments from them. In short, the knowledge of the schools and the participants framed and influenced my interpretation as the data were consistently compared with the respective school and participant backgrounds.

The four data sources complemented each other in this study and strengthened the research findings. The reflective journal entries provided a constant thread throughout the study as the participants began submitting the entries within the first week of the study and continued submitting reflections for four of the seven-month study. This consistent data source allowed me to constantly analyse the comments and compare them and the coding and categorisations to the three other sources. During the data analysis stage, the Learning Activities Survey – Professional Development in Technology teacher questionnaire was informed by the journal entries as I was able to confirm patterns, extracted from the journal entries, in the free-response questionnaire section and in the choice of statements and contributing factors. Similar commonalities and confirmations occurred in the semi-structured interview data. As was indicated earlier, the reflective journal entries and teacher questionnaire data assisted me in designing the schedule of interview questions, and, as there were several comments that required clarification or elaboration, these responses were explored during the interview. The last complementary data source, my field notes, not only served the purpose of recording informal remarks from the participants but also of tracking my own thoughts.

In this study, I have actioned Cranton and King’s (2003) five strategies for adult professional development with the intention of promoting transformative learning: action plans, reflective activities, case studies, curriculum development, and critical theory discussions. That is, I applied each of their strategies in the design of professional develop model utilised in my study.

Firstly, the initial catalyst for the participants was the professional development action plan. The teachers were able to decide what aspects of educational technology they wanted to learn, how fast and how much they wanted to learn, and what the indicators of success were for them. The action plans also allowed me to plan the interventions according to the individual and collective needs of the participants.

Secondly, I encouraged reflective activities through corresponding with the participants via email and telephone and during professional development workshops.

For example, at the conclusion of a workshop on webpage construction, I sent an email to the participants and asked that they consider under what circumstances they would use, integrate, or teach webpage construction in their respective classrooms.

Thirdly, during the educational technology workshops, the participants were given case studies vis-à-vis the addresses of websites constructed and maintained by teachers and students. They were asked to consider, in their journals, the advantages and disadvantages of creating and maintaining websites from their own perspectives; however, their comments were not formally shared with each other as my focus was on the individual, rather than the group, perspectives.

Fourthly, curriculum development through the professional development workshops was explored by allowing time for the participants to practise their newly-acquired ICT strategies on each other and to discuss the potential for adoption in their classrooms.

Finally, critical theory discussions occurred throughout the workshops as the participants were encouraged to apply the learning to their own teaching situations, to present and discuss the advantages and disadvantages of the software tools and educational strategies, and to self reflect on what strategies and curriculum they were presently teaching and the reasons for those educational choices. In this manner, the critical theory discussions allowed individual and group considerations of educational technology-related issues.

As well, the research studies discussed in the previous chapter (Apps, 1991; Caffarella, 1994; Cranton, 1996; Cranton & King, 2003; Galbraith, 1998; Kemp & Cochern, 1994; King, 2000, 2002a, 2002e; 2003; King & Lawler, 2003; Lawler, 1991, 2003; Lawler & King, 2000, 2003; Merriam & Caffarella, 1999; Taylor, Marienau, &

Fiddler, 2000) on the professional development of adults and adult learning principles (see Table 4) influenced me greatly in designing this thesis study.

Active participation (Cranton, 1994, 1996; King 2002a; Lawler, 1991, 2003) and building on past experiences (Cranton, 1994, 1996; King 2002a; Lawler, 1991, 2003) were addressed through the use of the professional development action plans (Cranton & King, 2003). The teachers decided what they wanted to learn, how quickly they wanted to learn, and what the measure of success was.

Climates of respect (Cranton, 1994, 1996; King 2002a; Lawler, 1991, 2003; Moran, 2001) and trust (Apps, 1991; Cranton, 1994, 1996; King 2002a; Lawler & King, 2000, 2003; Merriam & Caffarella, 1999) were created as the participants soon indicated that they respected and trusted me and each other (journals; emails; field notes). As well, for the teachers to practise aspects of educational technology, an element of trust for each other and for me had to be present (Apps, 1991; Cranton, 1994, 1996; King, 2002a; Lawler & King, 2000, 2003; Merriam & Caffarella, 1999; Moran, 2001). The trust for each other had been established through several years of working together and the trust for me was based on prior experiences with me or on my reputation as a professional development facilitator.

Each teacher was encouraged by me to adopt a critical attitude (Cranton, 1994, 1996; Lawler, 1991, 2003; Lawler & King, 2000, 2003; Merriam & Caffarella, 1999; Moran, 2001) so that they did not merely accept what I purported but also challenged the information or its use in their classrooms. I encouraged varied perspectives (Cranton, 1994, 1996; King, 2002a; Lawler, 1991, 2003; Lawler & King, 2000, 2003) in the professional development workshops so that the participants were exposed to not only my opinion but also the others' opinions through website readings.

The principle of empowerment (Cranton, 1994, 1996; King, 2002a; Lawler, 1991, 2003; Lawler & King, 2000, 2003; Moran, 2001) was constant throughout my study as the teachers often commented on how they felt in control of their learning processes by critically self-reflecting on what was, in effect, their belief systems and alteration of their frames of reference. A primary purpose of the professional development workshops was immediate application (King, 2002a; Lawler, 1991, 2003; Lawler & King, 2000, 2003) of the software tools and educational technology strategies so that the participants would experiment with the technologies through practice-based activities (Apps, 1991; Cranton, 1994, 1996; King, 2002a; Lawler, 1991, 2003; Lawler & King, 2000, 2003; Moran, 2001), decide if they were practical (Apps, 1991; Cranton, 1994, 1996; King, 2002a; Lawler & King, 2000, 2003; Moran, 2001) for their teaching situations, and if they were, try them with their students.

In short, by adhering to the literature concerning adult-learning principles, blended learning, and authentic learning environments in the design of the professional development model of my study (see Table 4, Chapter 1), I was able to address the second part of Research Question 1 of this study by examining the factors that assisted or impeded teachers in educational technology within a transformative learning framework.

The findings presented in the next chapter are authentic for several reasons. First, the sequential transformative research design was based on a respected theoretical framework of adult learning, posed strong research questions, utilised varied but complementary data collection procedures, and involved both qualitative and quantitative research methodologies (Cresswell, 2003). Second, I recognised that there would be deficiencies in each data collection instrument; however, by combining the strengths of each source, the research design became stronger which maximised reliability of the findings and their analysis. Last, the categorisation of the data involved the 11 broad phases of transformative learning theory (King's, 2002a, 2002e) as well as the more precise elements of transformative learning theory (Mezirow, 1985, 1991, 1995, 1998, 2000). This combination of broad and narrow categorisation and coding not only framed and influenced the data interpretation but also will inform and contribute to the research literature.

CHAPTER 3

RESEARCH RESULTS

Transformative learning theory is very complex. It involves various dimensions and levels that can be articulated through altered meaning schemes or meaning perspectives, habits of mind, and points of view and is realised through critical self-reflection (Cranton, 1997; King, 2002a, 2002e, 2003a; LaCava, 2002; Mezirow, 1985, 1990, 1991a, 1994b, 1997, 2000). Therefore, the data collected in this doctoral study were examined from many angles and through many lenses (Cresswell, 1998; Gall, Borg, & Gall, 1996; Hodson, 1991; Huberman & Miles, 1998; King, 2002a, 2003; Moustakas, 1994) in order to detect the presence and degree of perspective transformation and its related factors experienced by the 10 participants.

Having designed a defensible research study (Chapter 2) that is based on sound adult-learning principles (Apps, 1991; Caffarella, 1994; Cranton, 1996; Cranton & King, 2003; Galbraith, 1998; Kemp & Cochern, 1994; King, 2000, 2002a, 2002e; 2003; King & Lawler, 2003; Lawler, 1991, 2003; Lawler & King, 2000, 2003; Merriam & Caffarella, 1999; Taylor, Marienau, & Fiddler, 2000) and a mixed-methodology approach that combines both qualitative and quantitative research methodologies (Caracelli & Greene, 1993; Cresswell, 1995, 2003; Datta, 1994; Miles & Huberman, 1994; Reichardt & Rallis, 1994; Tashakkori & Teddlie, 1998, 2003), the resulting data are rich and informative. As each data collection instrument has limitations, I chose to use the strengths of each respective source to address the deficiencies in the others.

In the previous chapter (Chapter 2), the design of my research study was outlined with a particular emphasis on a general description of the schools and teachers, an overview of the data collection sources, and the explanation of the methods for coding, categorising, and analysing the data. In this chapter, the results of my doctoral study are presented in a systematic and thorough manner. Detailed information is provided on each of the three schools based on the data from the Technology Façade Checklist (Tomei, 2002), demographic information contained in the school handbooks, and telephone conversations with each administrator. As well, individual profiles on each teacher are provided using information supplied by the participants at the beginning of the study.

The pooled results by school showed that there were distinct differences between and among the three schools in relation to the total number of perspective transformations. As well, the pooled data by research instrument revealed some interesting trends that could be formed into four clusters according to the number of perspective transformation-related statements.

The pooled results by teacher highlighted several interesting trends. The professional development action plans completed by the teachers acted as a catalyst for the perspective transformations experienced by the 10 participants. However, the action plans also revealed that the type of intervention (email, workshop, and one-on-one tutorial) and the degree of contact (bi-weekly, weekly, monthly) from me might relate to the occurrence of perspective transformations experienced by the 10 participants. As well, there were clear differences between individual teachers in the degree of perspective transformations experienced as evidenced by the total number of transformative learning statements attributed to specific teachers by pooled response and by individual research instrument.

Overview

Schools

In an effort to set the context for each school, I requested specific demographic information from the respective administrators. I administered Tomei's (2002) Technology Façade Checklist to each administrator (see Table 9 and Appendices C, D, and E). As well, additional demographic data collected were: number of students, number of teachers and grades/subjects taught, monies allotted to technology, and any other facts that the administrator believed were relevant to educational technology.

The 20-item Technology Façade Checklist posed a series of statements that dealt with technology within the school and required the administrators to assign a ranking according to how they perceived the school's performance in relation to the criterion. The original purpose of the questionnaire was for the school administrator to know the areas of strength and growth in educational technology in relation to the key areas of technology use, the prerequisite infrastructure, and realistic instructional strategies (Tomei, 2002). My purpose for its use in this study was to create a profile of the school's present level of technology diffusion according to the principal's perspective and to allow comparison with each individual teacher's technology development and perspective transformation.

Table 9 presents the raw scores, as reported by each administrator, for the three Technology Façade Checklist sections, the total score for each school, and the transformed percentages for the raw scores.

Table 9: *Summary of the Technology Façade Checklist for Schools A, B, and C (raw score followed by percentages in parentheses)*

Façade Element	School A	School B	School C
Use of technology in a school (55 points)	38 (69.1)	45 (81.8)	34 (61.8)
The necessary infrastructure (104 points)	34 (32.7)	25 (25.0)	53 (51.0)
Viable instructional strategies (41 points)	30 (73.2)	25 (61.0)	30 (73.2)
TOTALS (200 points)	102 (51.0)	96 (48.0)	117 (58.5)

The principal of School A was asked to complete the Technology Façade Checklist (see Table 9 and Appendix A). School A received an overall score of 102 (of a possible 200 points) which resulted in a grade of "C-" and was characterised as in the "modest phase of the Technology Façade" (see Table 9). As will be noted later in this chapter, this belief was shared by the four participants from School A. The façade element of "viable instructional strategy" was clearly a strength (30 of 41 points, or 73.2%), followed by the "use of technology in a school or school district" (38 of 55 points, or 69.1%), and "the necessary infrastructure" (34 of 104 points, or 32.7%) (see Table 9). Interestingly, the principal attributed the strength in instructional strategies to the freedom they had experienced due to the three Network of Innovative Schools grants that they had previously received. In short, School A appeared to have the necessary instructional strategies but not the infrastructure to support a strong cross-grade technology program (see Table 9).

The current principal of School B eschewed the opportunity to complete the Technology Façade Checklist due to the fact that she had only been in the school for five months. Her predecessor agreed to complete the survey instrument as he was much more familiar with the technology (see Appendix B). School B received an overall score of 96 (48.0%) which resulted in a grade of "D+" and a qualifier of "Moderate phase of the Technology Façade" (see Table 9). Interestingly, this perception was not shared by the three participants in the school. The façade element of “use of technology in a school or school district” (45 of 55 points, or 81.8%) was clearly a strength, followed by the “viable instructional strategy” (25 of 41 points, or 61.0%), and “the necessary infrastructure” (26 of 104 points, or 25.0%) (see Table 9). In short, School B, unlike Schools A and C, appeared to demonstrate a strong use of educational technology in the school but, like Schools A and C, did not have the infrastructure to support a strong cross-grade technology program (see Table 9).

In School C, the Head of the Junior School was requested to complete the Technology Façade Checklist for the junior school (see Appendix C). School C received an overall score of 117 which resulted in a grade of “C+” and a qualifying description of “Modest phase of the Technology Façade” (see Table 9). Two of the three participants (C – 1 and C – 2) shared the administrator’s perception as demonstrated by their comments. The façade element of “viable instructional strategy” was clearly a strength (30 of 41 points, or 73.2%), followed by the “use of technology in a school or school district” (34 of 55 points, or 61.8%), and “the necessary infrastructure” (53 of 104 points, or 51.0%) (see Table 9). It should be noted that the Head of the Junior School based his assessment on his own experiences as the information technology teacher and on the teaching by the grade six Social Studies/grade seven Science, and grade four teachers as the four teachers used technology extensively.

In short, the junior school, like School A, appeared to have the necessary instructional strategies but, like Schools A and B, not the infrastructure to support a strong cross-grade technology program (see Table 9).

School A

School A was a state-of-the-art facility when it opened in 1996 and had considerable computer support and equipment; additionally, during the last two years, few funds were expended for computer support. The school had 330 students in grades kindergarten to seven and 13 classroom teachers, one Learning Assistance teacher, one Special Needs Support teacher, one Teacher-Librarian, and one Music teacher. There was no Technology Specialist teacher; however, the combined Grade Four and Five teacher was given 0.1 release time, or 2.5 hours per week, to maintain the computer lab. School A clearly had the necessary infrastructure to implement educational technology (see Table 9).

In 2003, on the Ministry of Education's annual test of student achievement, the Foundation Skills Assessment (FSA), 51% of Grade Four students were meeting or exceeding expectations in reading comprehension; 68% in writing; and 66% in numeracy (Ministry of Education, 2004). Several of the teachers had been recognised for their accomplishments from Science Teacher of the Year to writing math textbooks to coordinating writing research for the Ministry of Education.

There were 48 Microsoft Windows 1998 PCs and one iBook in the school—one PC in each of the 13 classrooms and the Learning Assistance classroom, 31 in the computer lab, one in the teacher preparation room, three in the school library, and two laptops. The student-to-computer ratio was 6.7, above the median (5.0) for medium-sized schools in Canada (Statistics Canada, 2004). The teachers were assigned one-half hour blocks in the computer lab; however, the intermediate-level teachers, Grades Four to Seven, received twice as much time, or four one-half hour blocks per week, as the primary-level teachers, kindergarten to Grade Three. This was because the principal indicated that the intermediate students were perceived as needing more time to work on more extensive projects (i.e., more time- and labour-intensive) while the primary children were described as having limited attention spans. These factors were reflected in "use of technology in a school" and "viable instructional strategies" in Table 9.

The budget allocated to technology spending met the Ministry of Education guidelines of 20% of the Learning Resources budget. This amount equated to $5,000 on technology resources in the 2002 academic year and $1,200 in 2003. In addition, School A was the first elementary school in British Columbia to receive a Network of Innovative Schools (NIS) grant which resulted in a $10,000 grant for each of three years. The recognition was for outstanding and unique ways to use Information and Communications Technology (ICT) in the classroom. The school used much of the grant in the first year to purchase computer hardware; to support professional development in the second year; and to finance software and a data projector in the last year. The two main software applications used by all teachers in the school were Accelerated Reader and computerised report cards.

School B

School B was a relatively new school as it opened in 2001. There were 296 students in grades kindergarten to six and nine full-time and six half-time classroom teachers, a half-time librarian, one Music teacher, and one Learning Assistance/Resource Room teacher. There was no Technology Specialist teacher; however, the Learning Assistance/Resource Room teacher was the "unofficial" specialist but received no release time.

In 2003, on the British Columbia Ministry of Education annual test of student achievement, the Foundation Skills Assessment (FSA), 85 percent of Grade Four students were meeting or exceeding expectations in reading comprehension; 98% in writing; and 94% in numeracy (Ministry of Education, 2004).

There were 76 iMac computers in the school—three in each of the 12 classrooms, four in the Learning Assistance/Resource Room classroom, 32 in the computer lab, and four in the school library. The student-to-computer ratio was 3.9, below the median (5.0) for medium-sized schools in Canada (Statistics Canada, 2004). The teachers were assigned one-hour blocks in the computer lab and all classroom teachers appeared to use the time allotted to them at least once a week. The budget allocated to technology spending was aligned with the Ministry of Education guidelines of 20% of the Learning Resources budget and added up to be $2,000.

School C

School C was an independent school, divided between junior (kindergarten to Grade 7) and senior schools (Grade 8 to 12), and was founded in 1921 as an all-girls school. The junior school became co-educational in 1988. The junior school had 110 male and female students in grades kindergarten to seven and 16 full-time teachers—12 classroom teachers, one specialist in Information Technology, Music, French, and Art, respectively. The senior school offered the entire British Columbia high school curriculum to its 120 female students.

In 2003, on the Ministry of Education annual test of student achievement, the Foundation Skills Assessment (FSA), 100% of Grade Four students were meeting or exceeding expectations in reading comprehension; 100% in writing; and 100% in numeracy (Ministry of Education, 2004).

This school assigned $50,000 to its technology budget for the entire school, kindergarten to Grade 12; however, the majority of the operating budget was consumed by the senior school's needs. The specific breakdown for spending was hardware updates ($15,000), SYSTEN software upgrades ($6,000), workstation software upgrades ($6,000), operational and maintenance contracts for software ($3,000), new software ($3,000), website hosting ($30), and senior lab computer replacements ($ 22 000). There were three computer labs with 20, 21, and 5 Dell PCs, respectively. The student-to-computer ratio was 7.2, well above the median (3.1) for medium-sized mixed elementary and secondary schools in Canada (Statistics Canada, 2004).

First priority for the booking of the labs was given to the information technology teacher, then the senior school teaching staff (Grades 8 to 12), followed by the intermediate teachers (Grade 4 to 7), and, finally, to the primary-grade teachers (kindergarten to Grade 3). The grade six Social Studies and grade seven Science teachers, respectively, used the computer lab once or twice a week; no primary teachers reported using any of the computer labs. A data projector was available to all teachers; however, its primary purpose was to assist the Information Technology teacher in her daily teaching. The whole school used a computerised report card system based on a Microsoft Access database.

Comparison of results by school

As outlined in the previous chapter (Chapter 2), the data from all sources were pooled to see if differences existed between and among the schools. That is, the 1373 transformative learning-related statements were separated by school to see which school contributed the most statements.

The pooled data results revealed significant differences among the three schools. In particular, the number of responses across all data sources showed that School A participants reported the highest frequencies of perspective transformations ($\Sigma = 598$), followed by School B ($\Sigma = 439$), and School C ($\Sigma = 336$).

Table 10 summarises the pooled data results by Learning Activities Survey – Professional Development in Technology statements (see Table 8, Chapter 2) in relation to each school and provides overall totals and sample quotes from the data sources.

Table 10: *Pooled data totals by school and overall total*

No.	LAS – PD TECH statements	School A	School B	School C	Total	Sample quote
1	I had an experience that caused me to question the way I usually act.	123	93	63	279	"This is the first time in my long career that I have actually had to work hard at enjoying teaching, and I am fast losing patience with the group as a whole. I am usually very optimistic and positive about classes and their potential. But this year, I actually have to force myself to go into this class. And I feel very ineffective."
2	I had an experience that caused me to question my ideas about social roles.	56	56	37	149	"I was definitely upset with teachers using computer time as a 'rest period' where students did what they wanted on the computer (play games) while the teacher marked, prepared lessons or just sat back and took it easy. This was unacceptable to me and I did not want to become this type of teacher."
3	As I questioned my ideas, I realized I no longer agreed with my previous beliefs or role expectations.	54	28	39	121	"I find myself [with the students] sending home more correspondence due to the ease, quickness and quality of the documents I can produce in a word processing program. I have also been experimenting with an online newsletter and calendar of events on my web page."
4	I realized that other people also questioned	32	22	17	71	"Lots of teachers, here, and in other schools, question

	their beliefs.					whether the tech is really worth the effort when there is no more money and little support.”
5	I thought about acting in a different way from my usual beliefs and roles.	46	26	18	90	“What frustrated me though was learning how to do it and then not doing it. Not going back to it but it just seemed a case of priorities. It just went to the bottom of the list … but I eventually buckled down and did it.”
6	I felt uncomfortable with traditional social expectations of teachers.	10	2	16	28	“So, really I have never felt confident or comfortable with computers.”
7	I tried out new roles so that I would become more comfortable or confident in them.	31	24	23	78	“And when I was able to feel that I had some power and control over what I wanted to learn, and learning about what I needed to learn for my students and for myself, then I felt more positive towards them or less negative about computers. And it was probably when I realized my influence on my students—my positive or negative influence.”
8	I tried to figure out a way to adopt these new ways of acting.	48	31	21	100	“I went from doing the whole thing handwritten, and then putting it on the computer, to just doing an outline and putting it on the computer, and now I can just compose on the computer which is wonderful. And that's just comfort.”
9	I gathered the information I needed to adopt these new ways of acting.	68	54	37	159	“I just watched other people do it. I watched someone with more experience show the students what to do. I watched that and modelled myself after that. So that’s how I learned.”
10	I began to think about the reactions and feedback from my new behaviour.	68	47	32	147	“While looking for pictures to add to the [WebQuest] project I stumbled across other web pages created by primary teachers and they

						indicated some of the 'tips' for teaching and making the WebQuests that came from the students and the teachers. I realized that was something that would really work for me…. That sort of feedback is useful to me as it comes from students and teachers who have actually used it."
11	I took action and adopted these new ways of acting.	62	56	33	151	"I decided to use technology as a tool to further develop my reading, writing, math goals or learning outcomes and job. I realized that I don't need a computer lab to teach technology. Two classroom computers and the four neighbourhood computers were fine."
	TOTAL	598	439	336	1373	

Examining the totals for the individual Learning Activities Survey – Professional Development in Technology statements, Statement 1, "I had an experience that caused me to question the way I usually act," recorded 20.3%, or 279 (see Table 10), of the total responses which was considerably more (120 points) than the second ranked Statement 9, "I gathered the information I needed to adopt these new ways of acting," with 11.6%, or 159 (see Table 11), of the total responses. Statements 2, 9, 10, and 11 were closely bundled while Statement 6, "I felt uncomfortable with traditional social expectations of teachers," had a significant gap (251 points) between it and the highest (Statement 1) and 43 points between it and the second lowest (Statement 4). Possible reasons for these results could be the technology infrastructure within the respective schools and/or factors related to perspective transformation. These results will be further explained in the next chapter (see "External Factors Related to Perspective Transformation," Chapter 4).

In terms of school differences, there were significant findings. Of the 1373 coded comments from the four data sources, School A participants reported 43.6%, or 598 (see Table 10), of the total responses and responded the most frequently to 10 of the 11 Learning Activities Survey – Professional Development in Technology statements. The exception was in the responses to the Statement 6, "I felt uncomfortable with traditional social expectations of teachers" category. School B participants reported 31.9%, or 439, of the overall total responses (see Table 10). In comparison with School C, the teachers in School B responded more frequently in nine of the 11 Learning Activities Survey – Professional Development in Technology statements (see Table 10). Lastly, School C participants reported the lowest percentage of responses, 24.5% or 336 comments (see Table 11). As well, the three School C participants collectively reported 16 times, the most of the three schools, that they were uncomfortable with the traditional social expectations of teachers (Statement 6). A possible reason for these results is the culture regime of the respective schools (Hargreaves, 2003) as will be discussed in the next chapter (see "School Culture," Chapter 4).

There was a clear difference among the means of the pooled data by type of schools: independent (School C = 30.5) versus public (Schools A = 54.4 and B = 39.9) (see Table 11).

Table 11: *Mean of pooled data totals and calculated by school (table t-value = 2.09)*

	School A	School B	School C
Mean	54.4	39.9	30.5
Calculated t-value	8.27	3.67	2.09

Using a two-tailed t- test for independent samples, I calculated that there was a statistically-significant difference between the means of School A and School C (8.27

> 2.09; p. < .05) and between the means of School B and School C (3.67 > 2.09; p < .05). In other words, there was a statistically-significant difference between the public schools (School A and B) and the independent school (School C). Because of the subtle, personal nature of perspective transformations, qualitative differences between the schools (see Table 10) are much more significant than the quantitative differences. The possible reasons for these qualitative and quantitative differences will be presented in the next chapter (see "External Factors Related to Perspective Transformation," Chapter 4).

Comparison of results from research instruments

The pooled data results revealed some interesting findings in relation to the research instruments. Table 12 summarises the pooled data results by Learning Activities Survey – Professional Development in Technology statements by data instrument and is divided into four distinct clusters.

Table 12: *Pooled data totals by research instrument, overall totals in rank order (greatest to least) and cluster*

No.	LAS – PD TECH statements	J[a]	Q[b]	I[c]	F[d]	Totals	Cluster
1	I had an experience that caused me to question the way I usually act.	18	6	238	17	279	1
9	I gathered the information I needed to adopt these new ways of acting.	7	4	148	-	159	2
11	I took action and adopted these new ways of acting.	21	4	114	12	151	
2	I had an experience that caused me to question my ideas about social roles.	7	4	134	4	149	
10	I began to think about the reactions and feedback from my new behaviour.	6	3	132	6	147	

3	As I questioned my ideas, I realized I no longer agreed with my previous beliefs or role expectations.	8	3	110	-	121	
8	I tried to figure out a way to adopt these new ways of acting.	3	6	91	-	100	
5	I thought about acting in a different way from my usual beliefs and roles.	5	5	80	-	90	3
7	I tried out new roles so that I would become more comfortable or confident in them.	5	8	61	4	78	
4	I realized that other people also questioned their beliefs.	8	3	60	-	71	
6	I felt uncomfortable with traditional social expectations of teachers.	6	2	20	-	28	4
	TOTAL	94	48	1188	43	1373	

J[a] = Reflective journal I[c] = Semi-structured interviews

Q[b] = Teacher questionnaire F[d] = My field notes

The number of responses across all data sources showed that the highest frequencies of perspective transformations were demonstrated during the semi-structured interviews (Σ = 1188), followed by the reflective journal entries (Σ = 94), the teacher questionnaire (Σ = 48), and my field notes (Σ = 43).

A closer examination of the data for individual Learning Activities Survey – Professional Development in Technology statements highlights interesting trends. These data appeared to group into four common clusters based on the range from the greatest (279) to the least number of responses (28), the range within each cluster, and the natural divisions between clusters (see Table 12).

The first cluster (Statement 1 in Table 12) represented the largest percentage of participant comments (n = 279 or 20.3%) which were made in relation to having an experience that caused them to question the way they usually acted. The difference, 120 comments, between the number of comments in the first cluster (n = 279) and the greatest number in the second cluster (n = 159) was significant and warranted further analysis in the next chapter (see “Time” and “Disorienting dilemma,” Chapter 4).

The second cluster (Statements 9, 11, 2, and 10 in Table 12) represented 44.2% of the overall total or approximately 10 percent for each statement. There was a small range (n = 12) within this cluster from 159 (Statement 9) to 147 (Statement 10). The range between scores was from 8 (between Statement 9 and Statement 11) to 2 (between Statements 11 and 2, and between Statements 2 and 10).

The difference between the fewest number of comments in the second cluster (n = 147) and greatest number in the third cluster (n = 121) was 26 comments. This difference between the second and third clusters was based on the range between LAS PD – TECH Statements 10 and 3, representing a difference of 26 comments. Reasons for this gap will be discussed in the next chapter (see “Individual Themes of Perspective Transformation” in Chapter 4).

The third cluster (LAS PD – TECH Statements 3, 8, 5, 7, and 4 in Table 12) represented 33.6% of the overall total and ranged from 8.9% (Statement 3) to 5.1% (Statement 4). In comparison with cluster two (n = 12), cluster three had a within-cluster range of 50 from 121 (Statement 3) to 71 (Statement 3). In comparison with cluster two, between-total differences were significant as LAS PD – TECH Statements 3 and 8 differed by 21 comments, Statements 8 and 5 by 10 comments, Statements 5 and 7 by 12 comments, and Statements 7 and 4 differed by 7 comments. The difference between the third and fourth clusters was based on the range between LAS PD – TECH Statements 4 and 6, representing a difference of 43 comments. Reasons for this gap will be discussed in the next chapter (“Individual Themes of Perspective Transformation”).

The fourth, and last, cluster (LAS PD – TECH Statement 6) represented the lowest percentage of participant comments (n = 28 or 2.0%) which were made in relation to how comfortable they felt with the traditional social expectations of teachers. The datum for the fourth cluster will be discussed further in the next chapter to provide explanation (see “Outside expectations” in Chapter 4).

The concluding chapter provides suggestions for future research (see “Recommendations for Future Research” in Chapter 5) based on these results and their analysis.

Teacher Results

Professional Development Action Plans

At the beginning of the research study, in line with sound professional development practice, I requested that each teacher complete a professional development action for educational technology (see Appendix F). The teachers were asked to indicate one to three goals to be met within a seven-month period (i.e., the length of the study), a start date, what type of assistance would be needed, who would provide the assistance, an example of how success would be demonstrated, and an end date. Every teacher completed their professional development action plans within one week of the request and all teachers supplied a copy for me.

Table 13 summarises the participants’ educational technology professional development action plans, the type of intervention provided by me, the frequency of contact from me, and whether the teachers were successful in completing each goal.

In total, the participants recorded 22 goals in their professional development plans of which 18 were successfully completed. In particular, School A participants met 11 of the 12 educational technology goals, School B teachers attained five of the

Table 13: *Summary of participants' educational technology professional development action plans*

	School A				School B			School C		
Teacher	A 1	A 2	A 3	A 4	B 1	B 2	B 3	C 1	C 2	C 3
Goal										
Is the time and money spent on technology worth it?	Y	Y	Y	Y	-	-	-	-	-	-
Learn how to use PowerPoint for the primary classroom	Y	Y	Y	Y	-	-	-	-	-	-
Learn how to use KidPix effectively in the primary classroom	N	Y	Y	Y	-	Y	-	-	-	-
To learn the advanced features of Clicker 4.0	-	-	-	-	Y	-	-	-	-	-
To use Appleworks 6 more effectively for preparation	-	-	-	-	-	Y	-	-	-	-
To ask for assistance when difficulties encountered	-	-	-	-	-	Y	-	-	-	-
To learn new features of iMovie 3	-	-	-	-	-	-	N	-	-	-
Learn how to manipulate graphics	-	-	-	-	-	-	Y	-	-	-
Learn how to use PowerPoint for personal use	-	-	-	-	-	-	N	-	-	-
Learn how to create and integrate WebQuest into curriculum	-	-	-	-	-	-	-	Y	N	N
Intervention	A 1	A 2	A 3	A 4	B 1	B 2	B 3	C 1	C 2	C 3
• Email	✓	✓	-	✓	✓	-	✓	✓	✓	✓
• Workshop	✓	✓	✓	✓	✓	-	✓	✓	✓	-
• Tutorial	✓	✓	-	✓	✓	✓	✓	✓	✓	-
• Model lesson	-	-	-	-	-	-	-	-	-	-
Contact	A 1	A 2	A 3	A 4	B 1	B 2	B 3	C 1	C 2	C 3
• Bi-weekly	✓	-	-	✓	-	-	-	-	-	-
• Weekly	-	✓	-	-	✓	-	✓	✓	✓	-
• Monthly	-	-	✓	-	-	✓	-	-	-	✓

seven goals, and School C teachers attained one of the three goals. The reasons that the four goals were not completed will be discussed in the next chapter (see "External Factors Related to Perspective Transformation" and "Individual Themes of Perspective Transformation" in Chapter 4). What is immediately noticeable is that the teachers who committed to more goals, generally accomplished all or all but one of their three or four goals, except for Teacher B – 3. In comparison, two of four teachers who committed to only one goal (n = 4) failed to accomplish that goal. Each of the teachers in School C had chosen the same goal of learning about WebQuests and how to create their own WebQuest, using Microsoft FrontPage for a curriculum-based project. Two teachers, C – 2 and C – 3, did not attain that goal. This compares poorly with the teachers in School A who chose the same three goals and only (A - 1) failed to accomplish all four. In sum, the vast majority of the participants' goals were met.

I offered support to the 10 participants in the forms of email messages (see Appendix J) and file attachments containing educational technology tutorials, in situ workshops, one-on-one tutorials, and model lessons. Eight of the 10 teachers requested and received support via email, workshop, and one-on-one tutorial tutorials (see Table 13). The two teachers who did not request email support, A – 3 and B – 2, indicated that they rarely accessed their email accounts as they were not comfortable with email attachments. The two teachers, B – 2 and C – 3, who did not attend the professional development workshops provided valid reasons—one teacher, B – 2, believed that she learned better when she could work one-on-one with me and the other, C – 3, was ill on the workshop days and did not want to bother me for something he could teach himself. The two teachers who did not ask for one-on-one tutorials, A – 3 and C – 3, indicated either that they did not see the need (A – 3) or they did not want to bother me for something that could be self taught (C – 3).

None of the participants chose to view a model lesson from me. Interestingly, those teachers who requested and received all of the other three forms of support, email, workshops, and tutorials, successfully completed 15 of their 18 action plan goals. The teacher, C – 3, who received only email support did not complete his action plan goal. The teacher, A – 3, who received only workshop support, completed her three goals. The teacher, B – 2, who received only one-on-one tutorial support completed her three goals.

The frequency of face-to-face contact varied from teacher to teacher. As mentioned in Chapter 2, the purpose was to allow them the opportunity to discuss their progress and to ask for assistance. It is noticeable that the teachers who met with me on a weekly basis completed seven of their nine action plan goals (77.8%), the teachers who had bi-weekly meetings with me completed five of their six goals (83.3%), and the teachers who had monthly meetings with me completed six of their seven professional development action plan goals (85.7%). It also noticeable that even though some (e.g., B – 3 and C – 2) used three interventions and met with me on a weekly basis, they did not achieve their action plan goals. This anomaly is explored in Chapter 4 (see “External Factors Related to Perspective Transformation”).

In sum, there were clear differences between and among the three schools (see Table 10 and 11), and it is clear that there were distinct clusters in the LAS – PD TECH statements represented (see Table 12), and noticeable trends in the teachers’ action plan goal completions (see Table 13). The relationships among data in Tables 10, 11, 12, and 13 will be explored: see “External Factors Related to Perspective Transformations” and “Individual Themes of Perspective Transformation” in Chapter

4. Additionally, the worth of each data collection instrument in terms of further research studies will be argued in the next chapter: see “Methodological Implications” in Chapter 4.

Individual teachers and the transformative learning statements

Demographic information was collected at the beginning of the study and additional information about each teacher was supplied via the professional development action plans. A brief description will contextualise the information about each teacher, with Table 14 summarising the demographic information in tabular form.

Table 14: *Summary of the demographic information for each participant*

Teacher	Gender	Age range	Prior Education	Range of teaching (years)	Grade level
A – 1	Female	50 – 59	B. Ed.	Over 25	Three
A – 2	Female	30 – 39	B. Ed.	11 – 15	Two
A – 3	Female	40 – 49	B. Ed.	Over 25	Two
A – 4	Female	40 – 49	Standard[a]	20 – 25	One
B – 1	Female	40 – 49	B. Ed.	1 – 5	LA/RR[b]
B – 2	Female	50 – 59	B. Ed.	20 – 25	Two
B – 3	Female	40 – 49	B. Ed.	Over 25	Six
C – 1	Female	50 – 59	B. Ed.	Over 25	Eng[c] 7/HE[d] 5 – 10
C – 2	Female	40 – 49	B. Ed.	6 – 10	Five
C – 3	Male	50 – 59	B. Ed.	11 – 15	Fr[e] K – 7/SS[f] 5

a = Teaching licence
b = Learning Assistance / Resource Room
c = English
d = Home Economics
e = French
f = Social Studies

As can be seen from the table, the majority of teachers had been teaching for over twenty years, were over the age of 40, had achieved a bachelor degree, and was female.

Teacher A – 1

Teacher A – 1 has been teaching for over 25 years with last six years at School A. She started her career in the province of Ontario as a junior-high school teacher but moved to British Columbia in 1977. After having taught grade six for many years, she moved to grade three, five years ago, for personal, self-appointed reasons. She was the catalyst for colluding with the other three teachers on their identical action plan goals so that they would be able to collaborate on projects. Another reason was that the teachers shared an interest in learning the same software applications. Her action plan goals for this research project were to "evaluate [whether] the time and money spent on using/learning technology is [sic] worth it," "understand how to use PowerPoint as a program and how to use it effectively in a primary classroom," and to "understand how to use KidPix as a program and how to use it effectively." She expressed a great deal of frustration with the infrastructure for technology and the use of technology in her school. In addition, she found it very challenging to identify perspective changes as represented by the key statements on the Learning Activities Survey – Professional Development in Technology questionnaire.

Teacher A – 2

Aged between 30 and 39 years, Teacher A – 2 was the youngest, but not the most inexperienced, of the nine teachers. She had taught grade two for over 10 years and had become interested in the role of technology with beginning readers and writers over the past three years. For instance, she and Teacher A – 1 had previously collaborated in creating, contributing to, and maintaining a website for primary teachers and parents of primary children. In addition, the two teachers had learned the basic functions of iMovie and produced digital videos in their respective classes. Her action plan goals were to "evaluate the time and money spent on using/learning technology is [sic] worth it," to "understand how to use PowerPoint as a program and how to use it effectively in a primary classroom," and to "understand how to use KidPix as a program and how to use it effectively." Given their continuing collaboration, it was not surprising that these goals were identical to A – 1.

Teacher A – 3

Teacher A – 3 was one of the most experienced teachers with over 25 years in the classroom. However, she had the least experience with technology and saw the research project as an opportunity to learn some basic programs to be used in her Grade Two classroom. Like Teacher A – 1 and Teacher A – 2, her action plan goals were to "evaluate the time and money spent on using/learning technology is [sic] worth it," to "understand how to use PowerPoint as a program and how to use it effectively in a primary classroom," and to "understand how to use KidPix as a program and how to use it effectively." As this teacher intended to continue her collaboration with the other three teachers in the school, her goals were identical to theirs.

Teacher A – 4:

Teacher A – 4 was enthusiastic at the prospect of learning more about technology with her Grade One class. She had been teaching for approximately 20 years without a Bachelor of Education but with a Standard Certificate, which involved three, rather than four or five, years of teaching training. In order to capitalise on the collaboration with her more educational technology experienced peers, she identified identical goals: to "evaluate the time and money spent on using/learning technology is [sic] worth it," to "understand how to use PowerPoint as a program and how to use it effectively in a primary classroom," and to "understand how to use KidPix as a program and how to use it effectively."

Teacher B – 1

Teacher B – 1 had the least amount of teaching with five years of teaching; however, she was the most experienced School B teacher at using, integrating, and teaching technology. Her action plan goal was to learn the advanced features of Clicker 4, a language augmentation software program for special needs students. She was a Learning Assistance and Resource Room teacher and her job involved working with small groups of children whose special needs spanned the entire Special Education continuum from Down Syndrome to gifted. She saw Clicker 4 as another program that allowed students to become more independent in their learning and to express themselves more easily due to its pictographic-audio functions. In addition, she was the unofficial "technology expert" in School B as she often taught her colleagues various software programs.

Teacher B – 2

Teacher B – 2 had been teaching for over 20 years in this school district and had worked in several schools during that time period. Her action plan goals were "to understand how to use KidPix Deluxe 3 more effectively with (her Grade Two) students," "to use Appleworks 6 more effectively for my professional use," and to ask for assistance when she encountered any difficulties. She was also interested to explore how effectively technology could be integrated into the school and district goals of improving the literacy, numeracy, and social responsibility of all her Grade Two students but this goal was not identified in her professional development action plan goal as she believed that the goal was unattainable in the time period of this study.

Teacher B – 3

Teacher B – 3 was the most experienced generalist teacher in the group as she had been teaching for over 25 years. She appeared to be the most assured with the role that technology should play in the classroom even though she had the most limited experience with technology. Her action plan goal was to use technology more effectively; however, her specific objectives were to learn iMovie 3, to learn how to manipulate graphics, and to understand how to use PowerPoint for her own personal use outside of the classroom.

Teacher C – 1

Teacher C – 1 is a Home Economics (grades five to ten) and an English 7 teacher at School C. However, over her 27-year teaching career, she had taught in one additional province (Alberta) and territory (Yukon) in Social Studies, Mathematics, and Science. On the one hand, she reported that she had a fascination with technology and wanted to learn more about it. On the other hand, she reported that she was very concerned about the limited amount of time available to her in order to experiment with technology inside and outside the classroom. She solved this dilemma by using technology that would not be time intensive and that would be attainable given the school's limited technology resources. Her action plan goal was to learn how to create and integrate WebQuests into her English curriculum; she eventually decided on a WebQuest for the mechanics of writing.

Teacher C – 2

Teacher C – 2 has two Bachelor degrees and graduated from Malaspina University-College's Post-Degree Program in 1996, at which time she secured a teaching position at School C. She was keen to learn more about technology integration with her Grade Five students and had installed a computer in her classroom for that purpose. Nevertheless, she was disappointed that she had no Internet access or data projector in her classroom; however, this lack did not deter her from acquiring technology strategies and did not prohibit her from experiencing a perspective transformation. Her action plan goal was to learn how to create and integrate WebQuests into her Grade Five curriculum; she eventually decided on a WebQuest for the digestive system.

Teacher C – 3

Teacher C – 3, the only male of the participants, came to teaching later in his career. As French teacher for grades kindergarten through seven at School C, he saw technology integration as a challenge because he taught only one or two lessons per week in each class. Therefore, as he also taught Social Studies to one Grade Five class, he used the Social Studies class for the focus of the research study. He taught a weekly one-hour Social Studies lesson in the computer lab as one of the two intermediate teachers who used the lab. His action plan goal was also to learn how to create and integrate WebQuests into his Social Studies curriculum; he eventually decided on a WebQuest for the early explorers to Canada.

In sum, the backgrounds of the 10 teachers were varied and represented the range of elementary levels in the British Columbia school system: early-primary, late-primary, early-intermediate, late-intermediate, and Special Education. The action plan goals identified by the teachers were clearly student-centred as each teacher wanted to acquire educational technology skills that would directly benefit the students in their respective classrooms.

As indicated earlier in this chapter, the total number of transformative learning statement responses within each school also resulted in noticeable differences (see Table 10). As well, the comparison of data from research instruments for the three schools revealed significant differences (see Table 12).

Table 15 summarises the pooled data results by Learning Activities Survey – Professional Development in Technology statements in relation to each teacher, ranked greatest to least.

Table 15: *Summary of transformative learning statements by school and by teacher (in raw number)*

		School A				School B			School C			Total
No	Teacher	A1	A2	A3	A4	B1	B2	B3	C1	C2	C3	
1	I had an experience that caused me to question the way I usually act.	59	24	15	25	50	17	26	22	16	25	279
9	I gathered the information I needed to adopt these new ways of acting.	28	18	7	15	25	14	15	17	15	5	159
11	I took action and adopted these new ways of acting.	26	14	7	15	24	15	17	14	10	9	151
2	I had an experience that caused me to question my ideas about social roles.	24	9	7	16	30	15	11	16	13	8	149
10	I began to think about the reactions and feedback from my new behaviour.	24	18	12	14	20	15	12	15	13	4	147
3	As I questioned my ideas, I realized I no longer agreed with my previous beliefs or role	26	10	4	14	13	6	9	18	12	9	121

	expectations.											
8	I tried to figure out a way to adopt these new ways of acting.	22	9	9	8	12	9	10	7	7	7	100
5	I thought about acting in a different way from my usual beliefs and roles.	22	6	6	12	15	8	3	6	8	4	90
7	I tried out new roles so that I would become more comfortable or confident in them.	12	7	5	7	13	5	6	8	8	7	78
4	I realized that other people also questioned their beliefs.	18	6	4	4	13	5	4	4	6	7	71
6	I felt uncomfortable with traditional social expectations of teachers.	3	1	4	2	0	2	0	8	2	6	28
	TOTAL	264	122	80	132	215	111	113	135	110	91	1373

The individual teachers' transformative learning statements for School A ranged from a total of 264 to 80—a difference of 184 comments. Teacher A – 1 contributed 264 of the 598 comments (44.1%) related to the Learning Activities Survey – Professional Development in Technology statements. Teachers A – 4 (n = 132 or 22.1%) and A – 2 (n = 122 or 20.4%) reported approximately half the number as Teacher A – 1. Teacher A – 3 provided 13.4% (n = 80) of School A's overall comments and less than a quarter of the comments supplied by Teacher A – 1, and nearly half that of each A – 2 and A – 4. These results warranted further investigation as to why there existed such disparate results within the same school when A – 1 achieved three of her four goals but A – 2, A – 3, and A – 4 achieved all four professional development goals and particularly when all had the same four goals (see "School Culture," Chapter 4).

The overall results for School B ranged from 215 to 111, a difference of 114 comments. Teacher B – 1 contributed 215 of the 439 comments (49.0%) related to the

Learning Activities Survey – Professional Development in Technology statements. Teachers B – 3 (n = 113 or 25.8%) and B – 2 (n = 111 or 25.2%) reported approximately half the number as Teacher B – 1. In other words, the combined number of comments from Teachers B – 2 and B – 3 equalled approximately the same number of comments from Teacher B – 1. These results warranted further discussion to ascertain the reasons why B – 1 achieved her one goal, B – 2 met her three professional development action plan goals but B – 3 achieved one of her three goals, given that the three teachers were in the same school (see “School Culture” in Chapter 4).

The overall results for School C ranged from 135 to 91, a difference of 44 comments which was quite a disparity in comparison with Schools A and B which both had large gaps, 184 and 114, respectively. Teacher C – 1 contributed 135 of the 336 comments (40.2%) related to the Learning Activities Survey – Professional Development in Technology statements. Teacher C – 2 reported the second highest number of comments (n = 110 or 32.7%) for School C but only 7.5% fewer than Teacher C – 1. Teacher C – 3 provided 27.1% of School C’s overall comments (n = 91) but only 5.6% and 13.1% fewer than Teacher C – 2 and Teacher C – 1, respectively. Interestingly C – 1 met her action plan goal, received three interventions, and met weekly but C – 2 who received the same interventions and frequency of researcher contact did not meet her goal. C – 3 did not meet his goal but chose email intervention and monthly meetings with the researcher (see Table 14). These results will be explored further as to why there existed such similar results within School C when differences in goal success, intervention, and frequency of contact existed (see “School Culture” in Chapter 4).

Research instruments and the transformative learning statements

As indicated earlier in this chapter, the pooled results for the four research instruments revealed significant overall differences (see Table 12). There were also clear differences in which specific transformative learning statements were chosen by the teachers in relation to the administered data instrument.

Reflective journal

At the beginning of the research study, the teachers were requested to record their thoughts, opinions, concerns, and ideas about educational technology in the form of a reflective journal for the length of the research study, seven months (see Chapter 2). The journal entries were submitted via an email message or written as a Microsoft Word document and sent as an email attachment.

As previously outlined in Chapter 2, the three foci of the reflective journals were to allow the teachers opportunities to express their feelings and beliefs in an asynchronous environment, to facilitate communication between me and the participant, and to contribute to the interview schedule of questions. It should be noted that the teachers did comment on experiences that occurred prior to the study (n = 4) and those reflections were included in the data analysis as I wanted comments pertinent to their perspective transformations – no matter when they occurred. A large majority of the journal comments (90 of 94 or 95.7%) did relate to experiences within the seven-month timeframe of the study. The reflective journal comments, though usually brief, were rich in breadth and depth.

Table 16 summarises the reflective journal data by Learning Activities Survey – Professional Development in Technology statements reported by each participant.

Table 16: *Number of times a coded statement was reported by the participants in their reflective journals (by raw number and totals)*

No	LAS – PD TECH statement	A 1	A 2	A 3	A 4	B 1	B 2	B 3	C 1	C 2	C 3	Σ	%
11	I took action and adopted these new ways of acting.	7	3	-	2	-	2	2	1	2	2	21	22.3
1	I had an experience that caused me to question the way I usually act.	11	1	-	2	1	-	1	2	-	-	18	19.1
3	As I questioned my ideas, I realized I no longer agreed with my previous beliefs or role expectations.	4	-	-	3	-	-		1	-	-	8	8.5
4	I realized that other people also questioned their beliefs.	4	2	-	-	-	-	-	1	-	1	8	8.5
2	I had an experience that caused me to question my ideas about social roles.	3	-	1	-	1	-	-	2	-	-	7	7.5
9	I gathered the information I needed to adopt these new ways of acting.	2	1	-	-	1	-	-	2	1	-	7	7.5
6	I felt uncomfortable with traditional social expectations of teachers.	2	-	2	-	-	-	-	-	2	-	6	6.4
10	I began to think about the reactions and feedback from my new behaviour.	3	-	-	1	-	1	-	-	1	-	6	6.4
5	I thought about acting in a different way from my usual beliefs and roles.	3	-	-	-	-	1	-	1	-	-	5	5.3
7	I tried out new roles so that I would become more comfortable or	2	-	-	1	1	-	-	1	-	-	5	5.3

	confident in them.												
8	I tried to figure out a way to adopt these new ways of acting.	1	1	-	-	-	1	-	-	-	-	3	3.2
	TOTAL	42	8	3	9	4	5	3	11	6	3	94	100

On average, each teacher submitted three journal entries; however, the range was two to seven entries. The longest journal entry was six Microsoft Word pages (A – 1) while the briefest was two pages (A – 3). In general, the participants reflected on their frustrations and triumphs with using technology outside of the classroom, mostly for material preparation. As the study progressed, entries reflected the philosophical issues of technology integration and teaching.

There was a markèd difference of 31 perspective transformation-related comments between the top contributor, A – 1 (44.7%), and the next teacher, C – 1 (11.7%); she reported almost one-quarter the number of A – 1 (see Table 16). The eight remaining participants' total comments ranged from 9 (9.6%) to 3 (3.2%).

Teacher questionnaire

Three months after the research study began, the participants were given a teacher questionnaire, the Learning Activities Survey – Professional Development in Technology (King, 2002a, 2002e) (see Appendix A). The rationale of asking the participants to complete the questionnaire during the first two weeks of December and the last two weeks of January (see Figure 6, Chapter 2), or three months after the study began, was twofold: (1) I wanted the teachers to have two full months of interventions (October to November) in the form of email exchanges, professional development workshops, and tutorials so that they would have some background experiences on which to base their responses; and (2) the questionnaire responses augmented the semi-structured interview questions, especially the queries related to the factors which assisted them in their technology development.

The survey asked them, if applicable, to choose as many of the 11 statements as possible that described their educational technology experiences, to write down any related thoughts, and to choose the learning factors or activities that assisted them in completing their professional development action plans and/or in using, integrating, or teaching technology in their respective classrooms.

Table 17 summarises the teacher questionnaire data by Learning Activities Survey – Professional Development in Technology statements reported by each participant.

Table 17: *Participant responses to LAS – PD – TECH teacher questionnaire ("✓" = selected; "-" = not selected)*

	A1	A2	A3	A4	B1	B2	B3	C1	C2	C3	Total
I had an experience that caused me to question the way I usually act.	✓	✓	-	✓	✓	✓	-	✓	-	-	6
I had an experience that caused me to question my ideas about social roles.	✓	-	-	✓	-	✓	-	✓	-	-	4
As I questioned my ideas, I realized I no longer agreed with my previous beliefs or role expectations.	✓	-	-	✓	✓	-	-	-	-	-	3
I realized that other people also questioned their beliefs.	✓	✓	-	-	✓	-	-	-	-	-	3
I thought about acting in a different way from my usual beliefs and roles.	-	✓	-	✓	✓	✓	-	✓	-	-	5

I felt uncomfortable with traditional social expectations of teachers.	-	✓	-	-	-	-	-	✓	-	-	2
I tried out new roles so that I would become more comfortable or confident in them.	✓	✓	-	✓	✓	✓	✓	✓	✓	-	8
I tried to figure out a way to adopt these new ways of acting.	✓	✓	-	✓	✓	-	-	✓	✓	-	6
I gathered the information I needed to adopt these new ways of acting.	✓	✓	-	✓	✓	-	-	-	-	-	4
I began to think about the reactions and feedback from my new behaviour.	-	✓	-	✓	-	-	-	-	✓	-	3
I took action and adopted these new ways of acting.	-	✓	-	✓	✓	✓	-	-	-	-	4
TOTAL	7	9	-	9	8	5	1	6	3	-	48

An interesting pattern was revealed in these questionnaire data as the number of responses were divided into two groups. That is, the difference between the total number of perspective transformation-related responses attributed to each participant (except for A – 3 and C – 3) was either 2.1 percentage points or 4.1 percentage points. For instance, A – 2 and A – 4 contributed 18.8% of the total number and B – 1 contributed 16.7% of the total number of statements—a difference of 2.1 percentage points. The same difference was noted between B – 1 and A – 1 (14.6%), A – 1 and C – 1 (12.5%), and C – 1 and B – 2 (10.4%). For the remaining three participants the difference between each participant was 4.1 percentage points: B – 2 (10.4%), C – 2 (6.3%), and B – 3 (2.1%).

It should be noted that two teachers, A – 3 and C – 3, reported that they had not experienced any perspective change due to their technology development.

However, their responses in their journals (see Table 16) and during the semi-structured interview (see Table 18) as well as their comments to me, as recorded in my field notes (see Table 19), belied the fact that they did experience a perspective transformation.

Perhaps it was the instrument itself that caused the teachers to eschew response. This will be capitalised in Chapter 5 (see "Recommendations for Future Research").

Semi-structured interview

Six months after the research study began, the teachers were interviewed at their respective schools. Each interview was 26 to 72 minutes in duration—the average length was 57 minutes. The wide range in interview length is attributed to the fact that some teachers were more verbose in the journal entries and questionnaire comments so that they expressed fewer words during the semi-structured interviews. Most participants were thorough in their responses to the questions; however, one participant, Teacher C – 2, was reluctant to expand on her answers, despite prompting by asking the re-worded question later in the interview.

The focus of the semi-structured interview was to have the teachers clarify or expand statements made in the reflective journals or on the teacher questionnaire. As well, they were asked to elaborate factors that assisted or impeded them in their educational technology development. Lastly, they commented on the professional development model and theory, transformative learning, used in the study.

Table 18 summarises the semi-structured interview data by Learning Activities Survey – Professional Development in Technology statements reported by each participant.

Table 18: *Number of times a coded statement was reported by each teacher in his or her semi-structured interview (by raw number and ranked by totals)*

No		A 1	A 2	A 3	A 4	B 1	B 2	B 3	C 1	C 2	C 3	Σ
1	I had an experience that caused me to question the way I usually act.	44	20	15	19	45	16	22	17	16	24	238
9	I gathered the information I needed to adopt these new ways of acting.	25	16	7	14	23	14	15	15	14	5	148
2	I had an experience that caused me to question my ideas about social roles.	19	9	6	14	28	14	11	12	13	8	134
10	I began to think about the reactions and feedback from my new behaviour.	19	17	12	12	19	13	12	14	11	3	132
11	I took action and adopted these new ways of acting.	19	8	7	10	23	10	13	11	8	5	114
3	As I questioned my ideas, I realized I no longer agreed with my previous beliefs or role expectations.	21	10	4	10	12	6	9	17	12	9	110
8	I tried to figure out a way to adopt these new ways of acting.	20	7	9	7	11	8	10	6	6	7	91
5	I thought about acting in a different way from my usual beliefs and roles.	19	5	6	11	14	6	3	4	8	4	80
7	I tried out new roles so that I would become more comfortable or confident in them.	8	6	5	4	10	4	5	6	6	7	61
4	I realized that other	13	3	4	4	12	5	4	3	6	6	60

	people also questioned their beliefs.											
6	I felt uncomfortable with traditional social expectations of teachers.	1	-	2	2	-	2	-	7	-	6	20
	TOTAL	208	101	77	107	197	98	104	112	100	84	1188
	PERCENTAGE	17.5	8.5	6.5	9.0	16.6	8.2	8.8	9.4	8.4	7.1	100

There were slight differences in the total number of perspective transformation-related responses attributed to each participant. The greatest was between B – 1 (n = 197 or 16.6%) and C – 1 (n = 112 or 9.4%)—a difference of 75 comments or 7.2 percentage points. The next greatest difference, between B – 2 (n = 98 or 8.2%) and C – 3 (n = 84 or 7.1%) was 14 comments or 1.1 percentage points. However, the eight remaining interviewees' comments differed by less than one percentage point.

Field notes

Throughout the research study, I kept field notes in digital or written form. If a teacher made a comment related to the aim of the study or to the two research questions, I either digitally recorded the information or wrote the reflections in a notebook. For the purposes of analysis, these comments were transcribed using Microsoft Word (see Appendix I).

Table 19 summarises my field notes data by Learning Activities Survey – Professional Development in Technology statements extracted from comments made by the nine participants.

Table 19: *Number of times a coded statement was extracted from my field notes (by raw number)*

No	LAS – PD TECH statements	A 1	A 2	A 3	A 4	B 1	B 2	B 3	C 1	C 2	C 3	Total
1	I had an experience that caused me to question the way I usually act.	3	2	-	3	3	-	3	2	-	1	17
2	I had an experience that caused me to question my ideas about social roles.	1	-	-	1	1	-	-	1	-	-	4
3	As I questioned my ideas, I realized I no longer agreed with my previous beliefs or role expectations.	-	-	-	-	-	-	-	-	-	-	-
4	I realized that other people also questioned their beliefs.	-	-	-	-	-	-	-	-	-	-	-
5	I thought about acting in a different way from my usual beliefs and roles.	-	-	-	-	-	-	-	-	-	-	-
6	I felt uncomfortable with traditional social expectations of teachers.	-	-	-	-	-	-	-	-	-	-	-
7	I tried out new roles so that I would become more comfortable or confident in them.	1	-	-	1	1	-	-	-	1	-	4
8	I tried to figure out a way to adopt these new ways of acting.	-	-	-		-	-	-	-	-	-	-
9	I gathered the information I needed to adopt these new ways of acting.	-	-	-	-	-	-	-	-	-	-	-
10	I began to think about the reactions and feedback from my new behaviour.	2	-	-	-	1	1	-	1	-	1	6
11	I took action and adopted these new ways of acting.	-	2	-	2	-	2	2	2	-	2	12

	TOTAL	7 2 - 7	6 3 5	6 1 4	43

These data revealed four interesting trends. First, nine of the 10 participants made references dealing with transformative learning and educational technology—the one exception was Teacher A – 3. Second, the nine teachers commented on only five of the 11 statements. In other words, six Learning Activities Survey – Professional Development in Technology statements had no comments attributed to them. Third, there was a much lower number of perspective related-comments offered by the participants in my field notes compared with the reflective journals, teacher questionnaires, and semi-structured interviews. Fourth, and last, no one statement had all 10 participant responses assigned to it.

Conclusion

This research findings chapter has outlined the results from all data sources. In describing the results, I have purported several trends related to the two research questions. The analysis of those trends will be presented in the next chapter but suppositions will be mentioned briefly in this chapter.

First, school differences were apparent in the data as more perspective transformations appeared to have occurred in School A (n = 598) than in School B (n = 439) and School C (n = 336). It would appear that the culture in the school affected the transformative learning process. In addition, the type of school—public or independent—was significant as evidenced by the two-tailed t-tests and the statistically-significant differences between the public and independent schools, and by the Technology Façade Checklist (Tomei, 2002) totals. The private school administrator indicated that he was confident in his teachers' abilities in technology diffusion (n = 117). However, the three School C teachers recorded the fewest number of perspective transformations (n = 336) in comparison with School A whose administrator ranked the school at the modest level of educational technology (n = 102) and yet whose teachers reported 43.6% of the overall transformative learning statements.

Second, the amount of researcher intervention and frequency of contact appeared to maximise the success for completion of the professional development action plans. That is, the teachers who utilised email, one-on-one tutorials, and workshops were consistently more successful in completing their action plan goals than those teachers who requested one or two interventions. The one teacher, C – 3, who did not capitalise on my forms of assistance, did not complete his action plan. In addition, the frequency of face-to-face contact combined with the intervention appeared to further maximise the successful completion of the action plan goals. For example, A – 2, A – 4, B – 1, and C – 1 met with me weekly, participated in professional development workshops, email discussions, and one-on-one tutorials and successfully met their action plan goals.

Third, the type of research instrument dictated the quantity and quality of perspective transformation comments provided by the participants. The highest frequencies of perspective transformations (Σ = 1188) were demonstrated during the semi-structured interviews, followed by the reflective journal entries (Σ = 94), the teacher questionnaire (Σ = 48), and my field notes (Σ = 43). While these data are not surprising due to the fact that the interviews were conducted using a schedule of questions, were data based on the questions developed from comments made in the journals, questionnaire, and field notes, and were lengthy, the quality of entries in the reflective journals were equally rich in terms of the number of perspective transformations.

Fourth, and last, the data also appeared to demonstrate that perspective transformations occurred among all 10 participants, in varying degrees, as evidenced by the overall total (n = 1373) and specific totals for each Learning Activities Survey – Professional Development in Technology statement which ranged from 28 – 279 comments. In other words, unlike King's (1997a, 2002a, 2002e) and LaCava's (2002) research studies that demonstrated the existence of perspective transformations, these data appear to maximise the possibility that perspective transformations occur along a continuum in the sense that there were degrees of perspective transformation. It would appear that some teachers experienced perspective transformations more often, to a greater degree, and, possibly, for longer periods of time.

CHAPTER 4

DISCUSSION

As articulated in Chapter 1, the concept of perspective transformation is the fundamental concept in transformative learning theory. Further, it was argued that individuals can experience a perspective transformation involving a combination of elements. For example, one can experience a minimal perspective transformation through an altered meaning scheme while another person may experience a more complex perspective transformation involving elements such as a changed habit of mind or different point of view (Mezirow, 1994b, 1997, 2000). Regardless of the complexity of the perspective transformation, critical reflection or critical self-reflection are necessary elements as argued convincingly by Mezirow (1998, 2003) and Cranton and Carusetta (2004).

Having demonstrated (Chapter 3) that, due to their development in educational technology, all teachers in this study experienced perspective transformations. However, as will be further discussed in this chapter, some experienced minimal perspective transformations involving one or two transformative learning elements while others appeared to have gone through more complex perspective transformations. While these findings are consistent with transformative learning theory, this study appears to be the most comprehensive demonstration of transformative theory of learning in the context of teachers' development of understanding of uses of educational technology to support learning in their classrooms. Having demonstrated a tight fit between theory and practice in this context, it is also possible to ascertain how systemic and individual factors contributed to or impeded the teachers' perspective transformations.

Effective incorporation of information technologies by teachers in their schools has proven problematic (see e.g., Jones, 2004; Roblyer, 2003a; Vanatta & Fordham, 2004). Transformative learning provides the basis of sound andragogical theory for the design of programs to assist teachers in their development in educational technology (Cranton & King, 2003). However, transformative learning, as a research framework, has had very limited application in the context of teacher development in educational technology in the classroom (King, 1998, 2002a, 2002c, 2003a). In this chapter, the reliability and credibility of transformative learning theory as a research framework is established providing justification for further research using this framework.

The structure for the chapter commences with a discussion of the external factors related to perspective transformation, including a description of school cultures (Hargreaves, 2003). The purpose for this structure was to establish the context in which the perspective transformations occurred. Next, external factors that contributed to and impeded the individual perspective transformations experienced by the participants in their educational technology development are extracted from within the school cultures. Then, the individual themes are presented and exemplified from the data sources to outline the degree of perspective transformations experienced by the teachers. Next, an argument is made for using transformative learning as a research framework to describe the teachers' development in technology use, integration, or teaching. A working definition of a transformative learner of technology is purported based on the characteristics of the five teachers who appeared to experience the highest degree of perspective transformation. Lastly, the theoretical, methodological, and andragogical implications of this research study are discussed. It should be noted that I have included various tables in this discussion chapter because, besides being a re-presentation of the data presented in the results chapter, their role supports comprehension of the surrounding discussion of the complex perspective transformation theory in action.

External Factors Related to Perspective Transformation

This section addresses part of Research Question One: *What factors and personal characteristics external to the professional development program appear to promote or impede the teachers' perspective transformations?* The section is divided into two parts. The first outlines the school culture to ensure that the learning environments for each of the three schools are clearly set by describing the characteristics of each school in which the perspective transformations occurred. The second part uses the notion of school culture (Hargreaves, 1994, 2003) as a basis for identifying the systemic external factors that influenced the participants' perspective transformations.

School Culture

As outlined in Chapter 3, the administrator-reported scores on the Technology Façade questionnaire (Tomei, 2002) (Table 9) and the two-tailed t-tests (see Table 12) demonstrated that there were clear differences between and among the three schools. A deeper analysis of those differences revealed several interesting trends in relation to school culture and perspective transformations.

Hargreaves' (1994, 2003) conceptual framework, based on his research into re-culturing schools, has been used in this study to characterise the school environment differences. He argued for a

> more sophisticated understanding of how cultures and contracts can contribute to reinventing public education … so that it combines the mutual personal

> trust of relationships with the professional trust and accountability of performance contracts (Hargreaves, 2003, p. 163).

He posited a solution in the form of three culture-based regimes (strong-mutual; strong-hierarchical; weak) and two contract-based regimes (strong and weak) resulting in six possible scenarios which characterised school change (Hargreaves, 1994, 2003).

A detailed discussion of his research is beyond the scope of this chapter; however, in relation to the differences among and between schools, the three culture and two contract regimes are presented, with an explanation, in an effort to frame each school's culture. In brief, he described contracts as ways for schools to be rewarded (or not) for their performance while a culture regime is the ethos of the school. For example, a collaborative culture (characterized as a strong-mutual contract) would present a weak contract regime as it is doubtful that the culture would be driven to score well on outside performance standards and measures whereas a professional learning community (strong-mutual culture and a strong contract regime) would tend to work together for a common goal of raising performance standards.

The main source of data for characterising the school cultures was my field notes, augmented by the other three sources (reflective journal comments; teacher questionnaire responses; and semi-structured interview). Table 20 summarises the culture (strong-mutual; strong-hierarchical; weak) and contract regimes (strong; weak) for each school in this study.

School A is characterised as a collaborative culture regime as the teachers worked together on many *in situ* projects as well as funded projects related to university and ministerial initiatives (see Chapter 2). The physical layout of the school

Table 20: *Culture- and contract-based regimes (Hargreaves, 2003) by school*

	CONTRACT		
	Weak	Strong	CULTURE
School A	Collaborative culture	Professional learning community	Strong-Mutual
School B	Contrived collegiality	Performance training sects	Strong-Hierarchical
School C	Permissive individualism	Corrosive individualism	Weak

encouraged collaboration as the school was divided into four-classroom blocks or “quads”, so that an early-primary teacher was placed beside a late-intermediate teacher. As well, as part of the re-culturing process, the teachers ensured that any school change focussed on the achievement of, and benefits for, the students and on informing practice rather than on curriculum change or on improving standardised test scores. The avenue for this change was to engage in a culture contract of professional learning communities so that they could “bring together the knowledge, skills, and dispositions of teachers in a school or across schools to promote shared learning and improvement” (Hargreaves, 2003, p. 170). This professional learning community was realised in the school’s action of assisting new teachers—experienced and inexperienced—in learning about, participating in, and augmenting school-wide initiatives. This occurred with my project; specifically, the school elected to use the learning opportunities I provided to support teachers new to the school. The administrator in School A saw himself as an educational follower rather than a leader. For example, he supported the teachers in their independent decision-making and took part in their learning communities. Lastly, the actions of the School A teachers matched Hargreaves (2003) characterisation of a professional learning community. In particular, they researched opportunities through their school professional development representative, sent specific needs to me as the facilitator, attended my targeted workshop, and supplied feedback on the effectiveness and efficiency of the workshop to me as the facilitator (Hargreaves, 2003). The success rate in the completion of their professional development action plans in this study was another indicator that this school valued collaboration and professionalism.

As reported by the teachers, under the previous administration, School B had many initiatives and collaborative efforts imposed on the staff. This culture regime was one of contrived collegiality (see Table 20). Many of the teaching staff failed to initiate not only their own joint projects but also any "shared learning, and collective inquiry in such areas as action research, team-teaching, and curriculum planning" (Hargreaves, 2003, pp. 165-166). This phenomenon was evidenced in two ways, both under a previous administrator's leadership. Firstly, many of the teachers appeared to have been zealous about the imposed Guided Reading project two years prior to this study but few had maintained the necessary practice and reflection needed for sustainable improvement. Secondly, the thrust for technology infusion across all grades, initiated by the previous administrator, was kept up very minimally, as a staff, but quite conscientiously by the three School B participants in my study.

Under the present administrator's leadership, the teachers in School B were supported in meeting the school goals but the administrator did not take any initiative to assist the staff in technology infusion. School B relied on large-scale performance standards and set pedagogies which represented a culture contract of performing training sects. Hargreaves (1994, 2003) described "performing training sects" as groups of people who place a clear emphasis on highly-prescribed curriculum. The school remained focussed on the achievement levels of their students and perceived the best modes of improving scores were specific teaching methods and addressing the needs of the lower-achieving students. However, the school did not appear to embrace educational technology strategies as a viable method of improving test scores. In other words, the staff believed that "outside" test scores reflected the students' academic levels in contrast to their own curriculum-based assessments and that the methods of improving performance were to change teaching methods and to perform intense remediation with the lower-achieving students to increase the school's mean performance. The school shared the across-district goals of improving literacy, numeracy, and social responsibility; however, the other curricular areas appeared to receive only token emphasis. The teachers spent much of their professional development time attending in-school and district-wide professional development workshops, acquiring new strategies and strengthening existing pedagogies. To be sure, the construct of a performing training sect did bring to the forefront the importance of meeting the needs of low-achieving students and of looking carefully at the school and district goals. However, how the needs and curricula were to be approached was rarely discussed. This appeared to lessen the interest in technology infusion. Lastly, consistent with Hargreaves' (2003) analysis, the teachers in School B appeared to exhibit a deference to authority such that many of the decisions were made from a top-down, power-coercion model (Hord, 1992). As predicted by other researchers (Casey, 1996; Dede, 2000; Eshet, Klemes, Henderson, & Jalali, 2000; Fullan, 1999, 2001a, 2001b; Fullan & Hargreaves, 1996; George & Camarata, 1996; Means & Olson, 1995; Mulkin, 2003; Sandholz, Ringstaff, & Dwyer, 1997; Sashkin & Egermeier, 1992; Schiller, 2002), little change was initiated by the School B teachers in relation to their professional development in educational technology in this study.

School C had a staff of teachers who were accustomed to working in isolation, to attending workshops without colleagues, and to collaborating on projects only when participation was mandatory. This school culture is best characterised as a regime of permissive individualism (Hargreaves, 1994, 2003; see Table 20). Even the physical layout of the classrooms was conducive to individualism rather than to collaboration as the elementary classroom teachers were spread out across several hectares of property rather than in one section of the school as was the senior school. For instance, C – 1 might teach one class of English in the main building, a Home Economics class 0.5 kilometres away in the basement of the student residences, and another English class 0.5 kilometres across campus in one of the portable classrooms. This sort of physical set-up creates “barriers to widespread and sustained positive educational change and classroom improvement” (Hargreaves, 2003, p. 164). Furthermore, School C exhibited a culture contract of corrosive individualism as the school relied heavily on standardised tests, performance standards, and public image which caused the teachers to become worn down and bitter (e.g., “We are driven by what the [parents and press] think of the school rather than what we actually do” [C – 1]; “Tests are everything [but] they are not even classroom-based [since] they are standardized tests” [C – 3]). The focus was on school image and content area subjects (Hargreaves, Earl, Moore, & Manning, 2000) rather than on the students and the teachers (Hargreaves, 2003). There did not appear to be any incentive to venture outside of the status quo so the teachers tended to withdraw to their classrooms and rarely communicated with their colleagues.

School Culture Summary

The construct of school culture (Hargreaves, 1994, 2003) is helpful in understanding the global factors that contribute to the process of transformation as it relates to school environment. In particular, a school philosophy that espouses the use of school funds to promote instructional technology, the consultation with all teachers regarding educational technology decisions, the encouragement of collaboration as a major habit of mind, and the creation of professional learning communities lays the foundation for transformative learning to occur (King, 2002a).

Systemic External Factors

The previous section described the individual school cultures in which the perspective transformations occurred. This section provides a more detailed examination of the systemic external factors within the school cultures that promoted or impeded the perspective transformations of the 10 participants. The structure of this section is divided into seven sub-sections that relate to four promoting factors and three inhibiting factors to the occurrence of perspective transformations (see Table 21). These factors emerged from the analysis of the data. Each sub-section explains the factor and provides clear exemplars from the participants as reported in their reflective journals, teacher questionnaires, semi-structured interviews, my field notes, and by the responses given by the administrators on the Technology Façade questionnaire (Tomei, 2003).

Perspective transformations are always internal and individual to the participant so that no one perspective transformation is identical from one person to another. However, systemic external factors influence the individual's perspective transformation—positively or negatively—and are an integral part of the individual's changed frame of reference. Based on the analysis of the data, there were clearly external systemic factors within the school cultures that promoted or impeded perspective transformations for the teachers as they used, integrated, and taught educational technology.

For the purposes of exemplification, the comments from the 10 participants are presented verbatim. Where needed, inserted text is represented by square brackets, "[…]," to expand a shortened term (e.g., "distance ed" became "[distance education]"), to protect the identity of a person (e.g., "Joe" became "[another teacher]"), and to clarify or contextualise the participants' responses (e.g., "That relationship is new to me but I love it" became "That [collaborative] relationship is new to me but I love it").

Table 21 outlines the factors within the school cultures that promoted and impeded perspective transformations as reported by the teachers in this research study (also see Figure 8 in the next section).

Table 21: *External factors within school cultures that promote and impede the occurrence of a perspective transformation (by descending order)*

Factors Within School Culture			
Promote	Number of comments	Impede	Number of comments
Collaboration	64	Gauleiter[a]	18
Administrator support	19	Infrastructure	15
Time	14	Administrator pressure	8
Targeted funding	7		
Total	104		41

[a]Gauleiter: Someone who is overbearing, authoritative, and dictatorial in nature.

Collaboration

Collaboration is an important factor in promoting the occurrence of a perspective transformation. Collaboration often involves critical reflection and critical discourse (Mezirow, 2003) which occur when individuals discuss important issues with each other. All 10 respondents indicated that a major factor in their change in actions, beliefs, and reactions was the ability to collaborate (64 comments across three schools) with another person or group of like-minded individuals.

Two themes related to collaboration emerged from the analysis: school culture and type of collaboration. The themes highlight the juxtaposition between the level of collaboration and the type of collaboration. These themes are consistent with Hargreaves' (2003) research on the level of collaboration and Anderson's (2003) case studies on the type of collaboration.

The school culture (Hargreaves, 2003) was one of the two important themes that emerged from the collaboration data. The analysis of the data presented here supports the argument that the school culture is related to the degree of collaboration (42 comments across three schools).

School A, with its collaborative culture regime, timetabled monthly meetings to discuss the school goals (14 of 64 comments) and to reflect on the integration of technology into the present school goals of literacy, numeracy, and social responsibility (16 of 64 comments). School A also ensured that there was time available to meet with other schools to discuss their respective educational technology strategies (3 of 64 comments). Three teachers attended and presented their research at provincial and national conferences and shared their newly-acquired ICT knowledge with the staff at monthly meetings (2 of 64 comments). In addition, they used the funds and expertise gained from an outside agency, the Network of Innovative Schools, to augment and support the teachers' development in technology.

School B did not meet as a staff to discuss the role of technology, thereby, further demonstrating their culture regime of contrived collegiality. The administrator supported the teachers but did not take the initiative to have them infuse technology in their classrooms. Although it was apparent that a small group of teachers discussed technology within and outside the school (4 of 64 comments), the staff, as whole, did not take the opportunity to collaborate with other teachers, staffs, or schools. They also did not explore the possibilities of collaboration with outside agencies.

The junior section of School C felt isolated from the senior section and under-valued by the Head and Deputy Head of School in terms of their support of technology in their respective classrooms. The teachers attempted to meet as a junior school but time and inclination were described as inhibiting factors for the meetings to occur; however, the three participants in my study did meet occasionally with each other during the course of the research to discuss educational technology issues and strategies (3 of 64 comments). The school relied on funding from the Ministry of Education, school tuition fees, and gifts from patrons; however, they did not pursue collaborative relationships with any outside agencies.

There were qualitative differences between the public and independent schools in the areas of technology innovation and collaboration (cf. Anderson, 2003). For instance, in my study, the public schools were collaborating (School A) or were attempting to collaborate (School B). The independent school was at a stage where individual teachers were attempting to alter their meaning schemes and perspectives (Mezirow, 2000) but were not discussing their changes with their colleagues. This lack of opportunity for collegiality and collaboration resulted in embitterment and frustration for individual pioneering ICT teachers (e.g., “Test scores are everything here [but] we never have a chance to hear what each [teacher] does to achieve decent results with technology” [C – 3]) and a culture regime of corrosive individualism (Hargreaves, 2003) (e.g., “Why bother? We have one or two [teachers] who make a difference but they are burnt out” [C – 1]). As well, the independent school did not work with outside agencies and relied on provincial and local funds to support their technology innovation. While the two public schools were de facto provincially funded, they did, in varying scales from a great deal (School A) to limited (School B), collaborate with other schools and school districts. To sum up, on a continuum of technology innovation and collaboration, the independent school was at the beginning stage of technology innovation and collaboration while the public schools were at a more advanced stage of development.

The second theme was related to the type of collaboration. Anderson’s (2003) Second Information Technology Education Study – Module 2 conclusions pointed out that collaboration was an integral part of technology innovation. He provided three salient case studies from Australia, Canada, and the United States (see Chapter 1) that illustrated three types of collaboration: working together (1) within the school, (2) across the school district, and (3) outside the school system with outside agencies. His research demonstrated that these collaborations were crucial for successful education technology integration but he did not associate the collaboration with school culture.

The data in this study appear to support the argument that the type of collaboration is related to perspective transformations (22 of 64 comments). The data were divided into three types of collaboration: (1) collaboration with another person in the same school (15 of 64 comments); (2) collaboration with a small group within the school (4 of 64 comments); and (3) collaboration with another person outside of the school (3 of 64 comments) (see Table 21). No references were made to collaboration with a small group outside of the school.

The first type within this theme was collaboration with one other person within the same school (15 of 64 comments across three schools). Three reported on their experiences of working with another teacher within the same school: “If I hadn’t had the support of A – 1, I wouldn’t have succeeded” (A – 2 questionnaire), “A – 2 and I work together on many other [curricular] areas so educational technology collaboration was easy” (A – 3 interview), and “the librarian and I have worked together on iMovie. That [collaborative] relationship is new to me but I love it” (B – 2 reflective journal). It is clear that collaborating with another teacher within an immediate learning environment (Anderson, 2003) was an important factor for these teachers as they had an opportunity to work with teachers whom they trusted.

The second type dealt with collaboration with several colleagues rather than with just one colleague within the same school (4 of 64 comments from School A). One participant believed that a group was better for a collaborative learning environment as “a community of learners [was created] so we could share knowledge and successes and not-successes” (A – 4 interview). Another summed up the advantages of working with a small group of teachers to professionally develop in educational technology: “When we can plan, teach, and evaluate TOGETHER, we can grow so much more in technology (A – 1 reflective journal; original emphasis). Evidently, collaborating with more than one colleague contributed to the perspective transformations of these two participants such that they saw distinct growth in their own learning.

The third type of collaboration was that which occurred outside of the school with another person (3 of 64 comments from Schools B and C). Collaboration that occurred outside of their own schools was important for three participants, such that one teacher “knew that I wasn’t the only person going nuts over the [Individual Education Program computerised software] program. Another teacher, in a different school, said that she was ready to pack it in” (B – 1 interview). A second teacher commented that he

> found a like-minded person when I went to a [Second Language] conference so each year we sit down and discuss what we can and do with technology in our [Second Language] classrooms. I didn’t get the same results after working with my colleagues at [School C] and am certainly much more excited after meeting with [my colleague outside the school] (C – 3 interview).

A third argued that “when I get to compare notes on planning and teaching with other teachers [in other schools], I feel energized and ready to try out some neat ideas with technology” (B – 3 reflective journal). For these three teachers, it is evident that working with teachers who taught in other schools and districts was important not only to their technology development but also to their mental state.

Collaboration was an important factor that promoted perspective transformations. All 10 teachers emphasised the need to work with others within the school, district, and province so that they could learn more about educational technology. Collaboration would be expected in School A, with its collaborative culture regime (see Table 20), but the participants in Schools B and C did not appear to reflect their respective school cultures. The contrived collegiality culture regime of School B (see Table 20) implied little collaboration; however, the three participants in my study (as well as one other School B teacher) did meet “about every two weeks” (B – 1 field note) to discuss educational technology skills and strategies. School C’s permissive individualism culture regime (School C) also did not appear to encourage collaboration as "most teachers taught alone, away from scrutiny, in insulated classes" (Hargreaves, 2003, p. 163); however, the three School C participants did choose to meet "when they could" (C – 1 field note) to discuss educational technology strategies related to their professional development action plans. In short, the data from my study appears to reflect the argument that collaboration often begins with individuals trying to make a change in their own teaching (Anderson, 2003; Hargreaves, 2003; Kozma, 2003b; Zimmerman, 2001). As described in the previous chapter (see "Professional Development Action Plans," Chapter 3), in the context of this study, it was possible to support teachers in creating a collaborative sub-culture within a school culture that was non-collaborative once I had provided the opportunity to record their respective professional development in educational technology.

Collaboration as a factor for change, as described by these participants, was reminiscent of Anderson's (2003) argument that collaboration was important in his three technology innovation case studies in Australia, Canada, and the United States. These data also support Burn's (2002) findings that an opportunity to collaborate with other teachers (e.g., "creating a community of learners … so we could share knowledge and successes and not-successes" [A – 4]) is a predictor of successful technology integration, diffusion, and innovation. In addition, the fact that collaboration was the most frequently-cited contributor to perspective transformations (see Table 21) supports the research in technology innovation (Anderson, 2003; Burns, 2002; Kozma, 2003c; McGhee & Kozma, 2000, 2003), adult learning principles (Cranton, 1994; Day, 2004; King & Lawler, 2002; Lawler & King, 2000; Moran, 2001), and transformative learning (Cranton, 1996; King, 2002a; 2003).

Administrator Support

Another promoting factor that assisted teachers in changing their meaning schemes and perspectives was support from the administrator (see Table 21) to the degree that the teachers believed that an administrator would offer encouragement, provide technical assistance, and provide funds for their technology needs. These three dimensions of support from the administration were described by seven respondents.

The first was encouragement to continue with their personal growth plans in using technology effectively (9 of 19 comments) as exemplified by these two interview quotes:

> I think that probably my conversation with my [Administrator Officer] at the school [lessened my anxiety]. I thought that I had to do technology as much and as good as others. [She] told me that I just needed to work at my own pace [on my plan] and not worry about how slow I thought my progress was (B – 2).

> In this school, [the principal] has allowed technology be part of what I do. [and has] probably encouraged me to use technology and supported me in completing my action plan (A – 4).

In other words, the administrator support was either at an individual level and not mandated (Schools B and C) or at a systemic level at School A so that the teachers felt that they could use, integrate, and teach technology. This type of administrator support is important for perspective transformations to occur as the teachers feel confident in taking risks with technology when they know an administrator will support them as argued by Anderson (2003) and Tomei (2002).

The second dimension of administrator support was manifested in technical and strategy assistance (6 of 19 comments) which caused the teachers to believe that the administrators were not only helpful but also demonstrating a level of empathy for acquiring new skills. Three teachers expanded on this notion:

> And then [the principal] helped me with it. I didn't even want to touch it. I thought, "God. I can't do this." He kept saying that it was easy [based on his own professional development] but he also wanted people to use it so he said that he would do it with some of my kids. I needed 3 or 4 kids to do an enrichment activity so I did the filming but he did the editing with them (A – 1 interview).

> [The Junior Head] really believes in it, and he pushes you in a non-threatening way. Basically he says, "Have you thought of doing it this way?**"….** He is very knowledgeable about computers and has a way of making you want to work harder by telling you how hard he first found technology (C – 1).

> If I have a problem I can just go to [the Junior Head] and he can help me. He's encouraging and he doesn't get frustrated. And more importantly, he empathizes with me (C – 2).

For these three teachers, A – 1, C – 1, and C – 2, administrator support was in action rather than words. The administrator was someone who actually provided concrete support to the teachers when they required some form of technical assistance. This type of support was indicative of School A's collaborative school culture and professional learning communities but conflicted with the permissive individualism culture and corrosive individualism regime of School C (Hargreaves, 2003). As indicated earlier, collaborative support can occur from individuals who care about the learning processes of their staff rather than adhering to the culture regime of the entire school. This sort of action was an important factor related to perspective transformations as it reinforced the idea that the teachers can seek and receive assistance from an administrator who can empathise with their learning processes.

The last dimension of administrator support was evidenced in actual financial support in the form of professional development opportunities or purchase requisitions for educational technology (4 of 19 comments). One teacher, A – 2, stressed the importance of purchasing release time to practise her skills: "[The principal] will always hire a [substitute teacher] to cover my classes if I say that I need time off to practise a [software] program" (A – 2). Another teacher, B – 1, commented on the importance of receiving earmarked technology funding when requested: "I think that the administration that we have now [is financially supportive]. If I say to her, that we really need this [specific software program], she'll get it for me. Because she knows that I'll use it" (B – 1). In short, the administrator support for these teachers was in the form of monies to purchase equipment (B – 1) or to hire someone to teach the students while the teacher practised her technology skills (A – 2) which demonstrated the respect the Schools A and B administrators had for the two teachers. Specifically, the administrators did not impose unnecessary obstacles for teachers requesting money. Further the administrators gave their own time to help the teachers with their educational technology learning. For these two teachers, that type of support was important to their perspective transformations as the teachers felt confident in trying out new roles based on their confidence that hardware, software, and in-school time would be purchased if they needed it.

These three dimensions of administrator support (encouragement; technical support; financial support) are reinforced in the literature. Lawler and King (2000) argued that the level of support from the administrator will frequently lead to successful staff development and subsequent perspective transformations. The tenor of the participants' responses in this study is also consistent with Moran's (2001) notion that "any support they receive helps relieve the stress of the constant decision making" (p. 147). Jones' (2004) meta-analysis of 27 ICT research articles and reports demonstrated that, similar to my results, strong administrator support is a key ICT enabling factor. As well, Granger et al. (2002) argued, in their study of four Canadian schools, that encouragement from a principal led to teachers using educational technology more often and more confidently. Lawler and King (2003) stressed the importance of supporting adult learners by creating a climate of respect which often results in learners experiencing a perspective transformation. This climate of respect was reflected in this study (e.g., "I know that [the principal] respects all of us and maintains that level of respect even when he might not agree with your decision" [A – 4]). In addition, the emphasis on the importance of administrator support reinforces my earlier work in professional development of teachers in educational technology (Kitchenham, 2001a).

Time

Appropriate access to time is a significant factor in promoting the occurrence of perspective transformation. The teachers' comments reflected the need for more time to develop their educational technology abilities. In other words, for the teachers to experience perspective transformations, there has to be some time available from their teaching schedules. Often that time is connected to prudent allocation of funds so that the money needed for time is distributed effectively (Lawler & King, 2003).

There were three types of time needed; each related to what the participants perceived as the purpose of the time: (1) to learn the new skills and strategies (4 of 14 comments), (2) to discuss projects and ideas with colleagues (4 of 14 comments), and (3) to investigate educational technology practices in other classrooms and schools (4 of 14 comments) (see Table 21).

The first type was practice time to learn (4 of 14 comments). Three teachers commented on this need. As one teacher, A – 1, outlined, time to practise the new skills and strategies is important: “So much time and money, in my opinion, has been wasted going to workshops, initially, because I didn't [practise or] apply [the skills]” (A – 1 journal comment). Two teachers were more forthright in their comments which were recorded in my field notes:

> It is pretty easy to understand. If [the district] wants us to use and integrate technology, we need the time to work through the programs without the stress of having to prep classes. … Just give us the program and let us work away at learning it at our own pace so I feel empowered and proud of what I have learned. There are only so many hours in a day and I am willing to put in more work, if [some] time is given to me (B – 1).

> Practice. That is the answer to why we don’t integrate technology in our classrooms. If I had dedicated time to practise my technology [skills], I would use it, integrate, and teach it in the classrooms. In my opinion, if I have been given the time to listen to some guy from the [United] States tell us how to rejuvenate the school when he doesn’t even know the school, I have the time to practise something I see as far more valuable. The problem is I don’t get that time to practise (C – 1 interview).

For these three teachers, time to practise their skills is necessary and they expect the administrator to allocate resources to provide that time. As they practise the technology skills, they experience a perspective transformation and a resulting increase in confidence (Cranton & King, 2003). As they develop more confidence, they are more comfortable diffusing ICT in their classrooms (Jones, 2004; Russell & Bradley, 1997). As well, they become more conscious of their own learning processes as adults (Apps, 1991; Cranton, 1996; Cranton & King, 2003; King, 2002a).

The second type of time was time to discuss educational technology with other colleagues (4 of 14 comments). One teacher expanded on her journal entry during the semi-structured interview: “We need to have time to discuss what we see in our classrooms and for [other teachers] to tell us what they find in their classrooms” (A – 1 interview). Her colleague reiterated the importance of having time to discuss projects with other colleagues:

> Initially, we had the luxury of time to chat with other teachers because [the principal] hired substitute teachers. Now, for example, A – 3 and I make the time to discuss how we can mesh projects for our respective students, even though we do it in our own time (A – 2 interview).

This emphasis on collaboration reflects the importance of discussion time for teachers so that they can experience perspective transformations as well as reinforcing the significance of collaborative school culture in School A (Hargreaves, 2003).

The third type of time was time to observe educational technology practices in other teachers’ classrooms (6 of 14 comments). Two teachers recorded entries in their reflective journals on the need to have time for observing practices inside and outside their schools.

> The other day [during my preparatory period], I got to observe what [another teacher] was doing in the lab with his Grade Six class and it was fantastic. I felt like I could really try some of these techniques with my younger students after seeing what is possible with technology (B – 2 reflective journal).

> On my [Professional Development] Day, I went to [another school] to observe what they were doing with technology and it was amazing. Too bad we can't have that free time to see others when we need it (B – 1 reflective journal).

During the semi-structured interview, B – 2 and B – 1 expanded on their earlier journal entries: "I did try some of the strategies I saw [that teacher] using, and my students really learned a lot [based] on that one observation' (B – 2) and "I not only tried some of the techniques [observed on that day] but [also] had other teachers try some of them with some success" (B – 1). This request to observe other teachers' use of educational technology reflects the importance of seeing practice in other teachers so that these two participants can return to their respective classrooms and experiment with the similar strategies and skills. The comments also contradict the contrived collegiality culture in School B (Hargreaves, 2003) as the teachers observed ICT teaching during their own time rather than being mandated by the administrator (Hargreaves, 2003). As indicated earlier, the School B participants were collaborative and recognised the advantages of working with others despite working in a school culture that did not encourage such initiative. This study provided an opportunity for the participating teachers to create a counter culture within their schools.

Time to observe other teachers using technology was important to the perspective transformations of these two teachers as they reported on experiences that caused them to question the way they usually acted (LAS – PD TECH Statement 1) and to take action to adopt the new ways of acting (LAS – PD TECH Statement 11).

The teachers at School A had received 30 000 dollars (Canadian) over three years from an outside funding agency, the Network of Innovative Schools, and, as a staff, they had decided to spend the money on release days so that teachers could observe other innovative teachers, research software and hardware, or have a day to experiment with the new technology. Two teachers summarised this sentiment shared by all four School A teachers:

> And I must say with things like the webpage [for this study], if we didn't have some of that money in the school where I could sit for a day—school-time day—it would never have happened (A – 1 reflective journal).

> The [Network of Innovative Schools] grant allowed us to meet in small or large groups, to buy useful [software] programs, and to go to technology conferences (A – 4 interview).

This change in spending was the turning point in the successful perspective transformations of the School A participants as represented by these two teachers' comments.

These teachers appear not only to need time to practise (Lee, 1997) but also need the release time to observe practices of other teachers, inside and outside their schools (Manternach-Wigans & Bender, 1999), and to discuss these and other projects with colleagues (Jones, 2004). If the participants can see the application of educational technology by observation and immediately experiment in their own computer labs or classrooms as well as being given some release time (Jones, 2004), they might be more enthused to continue the practice time after school and at home and the potential for perspective transformation is further enhanced (King, 2002a).

Targeted Funding

Four teachers stressed the importance of how the IT funding was spent rather than simply increasing the money available for technology (7 comments; 4 from School A; 3 from School C). The teachers wanted to have direct input into how technology monies were allocated rather than merely being given more money without a clear goal for the incurred expenses. The participants indicated that the funds needed to be targeted for reasonable expenses rather than purchasing the fastest, largest, or most efficient technologies.

All four School A teachers reiterated the comments in the previous section on time. That is, they stressed that the money not only allowed them the time to acquire and practise their educational technology skills but also opportunities for collaboration and critical discourse with colleagues as substitute teachers were hired to teach their students. Such spending allows collaboration (Anderson, 2003; Romano, 2003; Tomei, 2002) and critical discourse (Mezirow, 2000) which are crucial elements in experiencing perspective transformations (Cranton, 1994, 1996).

A teacher in School C believed that prudent spending on what was needed in the classroom was an effective strategy: "If [the administrator or district personnel] asked us what [monies] we wanted spent for technology, we'd use it more, I'm quite sure" (C – 3 interview). In his last journal entry, he summarised the sentiment of four teachers across all three schools, "If they invested the money more wisely, more teachers would walk the walk with technology" (C – 3), thereby showing that teachers want to develop in technology but need reassurance that the available funds will be spent for technology that will support their development.

In short, the teachers argued that more money for technology was not the answer. This sentiment is supported by Anderson's (2003) study of Mountview school teachers who were successful in their technology development "without special funding or other special resources" (p. 214). In particular, the manner in which the funds were spent needed to be as carefully considered as the amount of money available. Indeed, four teachers, as represented by the preceding comments from three participants, felt strongly that they were more apt to consider their own development in technology if they knew that their own opinions and expertise had been considered when making further purchases. Targeted funding allowed opportunities to discuss, reflect on, and revise assumptions about educational technology. This factor supported perspective transformation as will be discussed in the "Elements of Transformative Learning Theory" section.

Gauleiter

The most predominant type of impeding factor was a gauleiter (see Table 21). There were 18 comments by six respondents about a colleague who was overbearing and authoritative in approach which impeded them from developing professionally (see Table 21). As collegiality and collaboration are important factors in promoting perspective transformations, it stands to reason the absence of these factors, in the form of a gauleiter, would hinder, retard, or prohibit the occurrence of a perspective transformation. Such a gauleiter's actions contradict sound adult learning principles (Galbraith, 2004; Lawler & King, 2001; Long, 2004; Moran, 2001) and diminish the likelihood of perspective transformations as teachers feel disempowered (King & Cranton, 2003). A gauleiter was manifested in a variety of types in this study.

The first type of a gauleiter was someone who made the teacher feel subservient to a colleague (9 of 18 comments). The following excerpt was precipitated by a situation where the gauleiter had ignored the established procedure by not signing out the laptop computer in the log book. The teacher, who had signed out the laptop, went to get it from the gauleiter who refused to give it up:

> If I want the laptop, I've got to go and ask that person. And he says, "How long are you going to have it?" and I'm thinking, "Okay, this is supposed to be housed in the office" but that's one of the hardest things in a school is that ... you don't want the fighting to go on and the "I need and you can't have" attitude (A – 1 interview).

A colleague in the same school also commented on this gauleiter's behaviour when she requested assistance as the lab administrator: "The one person that would have known all the answers to anything that I needed to learn was not going to be forthcoming in helping because he was resentful [and] his actions were disrespectful to me" (A – 4 interview). Being disrespected and subjected to a comment like "How long are you going to have it?" or withholding assistance as a spiteful action are demeaning and impeded the uptake of educational technology for these two teachers.

Another type of gauleiter appeared to be someone who dominated the teaching-learning process (5 of 18 comments). The following is exemplary of these five comments from four teachers.

> I would have to say when I have worked with [another teacher in the school] on computers, [he has] totally taken over and not allowed me any input. I've sat there and watched him do [the technology task] and learned nothing. I feel very frustrated and it's a waste of my time because I learn nothing (A – 4 interview).

Such gauleiter experiences leave the recipient feeling defeated and disempowered.

The third type of a gauleiter was a colleague who displayed disparaging rudeness towards another staff member (4 of 18 comments from three teachers):

> So he made me feel that it was his way or the highway. When I mentioned that you had taught me a different method, he just gave me the middle finger [gestures with middle finger]" (C – 1 interview).

This gauleiter example, in effect, stressed the importance of a unilateral approach to learning.

Making others feel less capable, inferior, and subservient contradicts adult learning principles and transformative learning. Cranton (1996) had argued that adults need to feel appreciated and in control of their own learning which has been supported by others (Galbraith, 2004; Lawler & King, 2001; Long, 2004; Moran, 2001). As well, this research supports that by King (1999; 2000; 2001, 2002d, 2002e, 2003), LaCava (2002), and Mezirow (1996, 1997, 1998, 2000) who maintained that, in contrast to gauleiter behaviour, it is collaboration and collegiality that are cornerstones to successful perspective transformations. Lastly, it is also evident that even in schools where there is a great deal of collaboration (e.g., School A) or an embryonic developing level of collaboration (e.g., School C), individual interactions can be damaging to the teachers' technology development.

Infrastructure

Another impeding factor was the absence of a strong infrastructure within the schools and school districts (11 of 15 comments). In the schools involved in this study, a significant part of the ICT infrastructure (e.g., technician support and Internet bandwidth) was external to the schools. For example, even though each school had "ICT-savvy" teachers on staff, those teachers' time was limited as they also were expected to teach classes 90 to 100 percent of their teaching schedules. For Schools A and B, district personnel were responsible for maintaining computer labs, repairing printers, and servicing Internet connections while an outside consultant performed the same tasks in School C. Ensuring that a strong infrastructure for learning, in general, and for educational technology, in particular, is in place is an integral component for perspective transformation (Cranton, 1996; King, 2003a; LaCava, 2002; Mezirow, 2002).

Nine teachers, that is, all but A - 3, reported that the infrastructure in their school or district was a major impediment to their professional development and, by extension, to their subsequent perspective transformations. Their comments described either a weak external infrastructure or a weak internal infrastructure.

Eight comments were offered by five teachers, three from School A and one each from Schools B and C, in relation to the lack of support from district personnel (8 comments). Three excerpts highlight clear dissatisfaction: “In fact, it’s the infrastructure that teachers think is stupid; it’s not the computer itself. It’s the external things that aren’t working” (C – 2 interview); “I think that the biggest problem’s been when it doesn’t work. And they’ll say, ‘We’ve got all this money tied up in these computers’!” (B – 3 reflective journal). Another interviewee, A – 2, commented:

> General staffroom talk: … I couldn’t be bothered to go to the lab today. I just couldn’t even take the chance today that [the computers] weren’t going to be working (A – 2 interview).

These three excerpts show the frustration with the inadequate external infrastructure for these three schools.

One teacher felt confident, with the arrival of a helpful “ICT-savvy” technology teacher within the school and from whom she received some support.

Nevertheless, she realised that this could not overcome the weak support from outside of the school:

> As far as being able to get the computers fixed and get somebody—a technical support person—here [pause]. Those are the people they've cut out in this district, so they come when they can come and they try to do what they can. It's frustrating for everyone. (A – 4 interview)

Another teacher in the same school recorded in her journal: "I get extremely upset and angry with the poor technology support outside of [School A]. I prepare lessons for the lab and can't use them because the damn lab is down. Again!" (A – 1 reflective journal).

Quite clearly, teachers from three different schools felt frustrated with their schools' external infrastructure as the technical support personnel were deliberately decreased in number. This was because the number of technicians was a result of either outside government decisions in two schools or by School C's decision to spend less on its ICT contract.

The second theme was weak internal school support (4 comments from all schools). A participant from the independent school, C – 1, reported that she could cope with technology within her classroom but felt more support was needed from the administrators in relation to requesting an increase in the number of Internet connections and the related hardware: "Infrastructure for sure. It's not the technology because the potential is there if the [wider] bandwidth and the Internet connections were there" (C – 1 interview). Her colleague was more direct: "What's the point of investing time and effort when you know the infrastructure will stop you in your tracks?" (C – 3 interview). Another teacher stressed that School B "had enough computers but frequently we can't get on the Internet and the computers freeze" (B –

1 field notes). A teacher in School A provided some levity with her comment that “it’s like everyone in the district goes web-surfing at 9:15 am and the whole district Internet shuts down” (A – 4 interview). These four teachers demonstrate the need for internal school support in the form of more reliable and robust access points to the Internet in their respective schools. The desire to use technology was present but the lack of internal infrastructure impeded perspective transformation.

Certainly one of the cornerstones of adult learning is to know that infrastructure is in place to support the learner, especially in technology development (Tomei, 2002). Jones (2004) concluded from his meta-analysis of the ICT literature that infrastructure in the forms of lack of access to resources (e.g., lack of hardware; inappropriate organisation of resources; poor quality software) and technical problems not being remedied quickly led to teachers giving up on technology infusion. King (2003) argued that these external and internal technical supports are necessary for perspective transformation as did her colleagues in transformative learning (Cranton, 1996; LaCava, 2002; Mezirow, 2002). King (2002; 2003a) demonstrated that a strong external infrastructure is also a major factor for adult learners as they learn new skills (King, 2002) and acquire new attitudes and beliefs in their transformative journey (King, 2003a).

Administrator Pressure

Another impeding factor was negative pressure from the administrators (8 comments across all schools) (see Table 21). Experiencing certain types of pressure from the administrator to develop in educational technology was characterised as a deterrent and impeded the teachers from changing their meaning schemes, meaning perspectives, and habits of mind. Like administrator support, administrator pressure came in several dimensions.

The first dimension was the pressure to use technology for the sake of using technology (4 of 8 comments). One interviewee indicated that she felt pressure from her administrator to use technology.

> [The Head of School] cornered me after a staff meeting and asked me to explain why I was not using technology in my English classroom. He indicated that I was required to use technology as soon as possible in whatever form I felt was necessary (C – 1 interview).

Another teacher reported that her administrator "made it quite clear that we were to use technology since the lab was accessible to all staff" (B – 2 reflective journal) to such an extent that the principal often "popped in my classroom to ask how my technology growth was going [in teaching] in the lab or in my classroom" (B – 2 field note). For these two teachers, the administrator pressure was perceived as so negatively intense that they found themselves apprehensive about using technology because of their respective administrators checking to ensure that they had used ICT in their classrooms, regardless of how the ICT was utilised.

The second dimension of administrator pressure was to integrate technology more frequently (2 of 8 comments from one teacher in School C). The respondent, C – 3, indicated that he felt pressure to increase his frequency of technology integration:

> I'm pushed into [integrating technology more frequently] through necessity. If [the Head of School] says that [more technology integration] is what we have to do, then I certainly will go out and do it (C – 3 interview).

However, he also stressed that the resulting effect was one of resentment rather than compliance: "I will [not] go out of my way to appease this sort of bully [and] I end up hating how I was treated". In fact, C – 3 did not achieve his professional development action plan goal of learning how to create and integrate WebQuests into the curriculum (see Table 14 in Chapter 3). This “passive resistance” way of acquiring educational technology skills (Fender, 1999; Janas, 1998) is not conducive to perspective transformations.

The last dimension of administrator pressure was to adopt the principal’s philosophy of teaching (2 of 8 comments from one School A teacher). This participant reflected on how strongly she felt about her treatment in a previous school.

> The person who was the administrator was not about to support that we do anything different [in educational technology] than what [he] wanted as I argued with him once and never got anything I asked for after that day. …. He was probably the reason I left the school (A – 4).

She felt so strongly about the pressure to conform to the administrator’s frame of reference that she took the drastic step of leaving her school. Additionally, she frequently commented on how much easier decisions were in her present school, School A, as the culture, teachers, and administrator were collaborative.

Administrator pressure was a clear external inhibiting factor for perspective transformations for these four teachers. The pressure could be such that the teacher believed that success was dependent on what the administrator said was to be accomplished or no support would be given (e.g., “The pressure to use technology after that [encounter] was stifling to me and it put me on the defensive” [C – 1]). The pressure could also lead to a teacher begrudgingly following the edict from the administrator without any level of commitment from the teacher (“I’m pushed into [integrating technology more frequently] through necessity” [C – 3]). The last dimension of administrator pressure was evidenced by a veiled-threat message that if the teacher did not adopt the administrator’s way of thinking then any future requests would not be granted (“I argued with him once and never got anything I asked for after that day" [A – 4]). Obviously, these three dimensions of administrator pressure represent impediments to perspective transformation.

Systemic External Factors Summary

The data from this study have shown that there were systemic external factors within each school culture that promoted perspective transformations (see Table 21) amongst the 10 participants. These factors ensured that meaning schemes and perspectives could be re-evaluated and reintegrated into present belief systems (Mezirow, 2003) by collaborating with other teachers, inside and outside their schools, by having a supportive administrator, by being allowed time to develop their educational technology abilities, and by utilising school funds for specific purposes. There were also external factors that impeded the occurrence of perspective transformations (see Table 21) as they interfered with the transformative journey in some manner (King, 2002a, 2002e, 2003). Specifically, the teachers were bullied by others, worked within a weak school and district infrastructure or felt different forms of administrator pressure.

External Factors Related to Perspective Transformation Summary

External factors can influence the opportunity for critical examination of one's assumptions about educational technology and therefore, the potential for perspective transformation. In this research study, there is evidence that school culture regimes are related to perspective transformations. For instance, the collaborative culture of School A (see Table 20) was very conducive to perspective transformations as the participants were encouraged by their colleagues and their administrator to learn more about educational technology, to discuss their experiences with each other, and to observe others, inside and outside the school, use, integrate, and teach technology.

School B's contrived collegiality and School C's permissive individualism (see Table 20) did not support perspective transformations related to educational technology; however, the individual participants in this study compensated by creating a sub-culture to meet for discussions about ICT in relation to their professional development action plan goals. Yet, in School C's case, it was not enough to result in success because C - 1 achieved her professional development action plan goal of learning how to create a WebQuest and how to integrate WebQuests into the curriculum while C – 2 and C – 3 did not achieve their goals which were identical to C – 1's goal (see "Professional Development Action Plans" and Table 13, Chapter 3).

Indeed, there were external factors within and outside the respective school cultures that proved conducive or detrimental to perspective transformations depending on the level of collaboration and administrator support, the amount of time allotted to practising educational technology skills and strategies, the prudent use of ICT monies, and the strength of the school and district infrastructure (see Table 21).

Individual Themes of Perspective Transformation

This section addresses the remaining part of Research Question One: *Given professional development opportunities consistent with sound andragogy, to what degree do teachers experience a "perspective transformation" due to their development in technology?* The Results Chapter established that there was variation in the perspective transformations of the teachers. The 11 Learning Activities Survey – Professional Development in Technology statements discussed in Chapter 3 were subsumed within the five individual themes of perspective transformation (see Tables 11, 13, and 15, Chapter 3). All 1373 comments were re-categorised into the five themes to further demonstrate the degree of perspective transformation experienced by the 10 participants in my study. This section explores the degree of experienced perspective transformations and is divided into six sub-sections, focussing on the five themes and 24 sub-themes related to the degree of perspective transformation experienced by the 10 participants. Each sub-section explains the theme and sub-themes and provides exemplars from the participants as reported in their reflective journals, teacher questionnaires, semi-structured interviews, and my field notes.

Figure 8 and Table 22 provide an overview of the external factors related to perspective transformation discussed in the preceding section as well as of the themes in this section.

Figure 8 shows the relationship between the systemic external factors related to perspective transformation which have already been discussed and which are now the focus of this section. The right-hand side of Figure 8 outlines the seven systemic transformative learning-related factors (see Table 21 in the "Systemic External Factors" section of this chapter). There are distinct headings to separate the factors that assisted in perspective transformations ("Promote") and the factors that impeded perspective transformations ("Impede"). All seven factors are listed in descending order, from greatest to least number of comments, and are joined with a line and arrows to show the direct connection to the main idea ("Factors: Systemic"). As well, a solid uni-directional arrow joins the systemic factors to the themes to represent that the individual themes are influenced by the systemic factors.

The left-hand side of Figure 8 represents the individual themes into which all responses were categorised (1373 comments; see Chapter 3). Rather than characterising the themes in descending order, from the theme with the greatest number to the least, they are arranged in the order of most favourable sequence for effective discussion. That is, a perspective transformation begins with a *disorienting dilemma*, which may be positive or negative (see Figure 8), so the first theme is

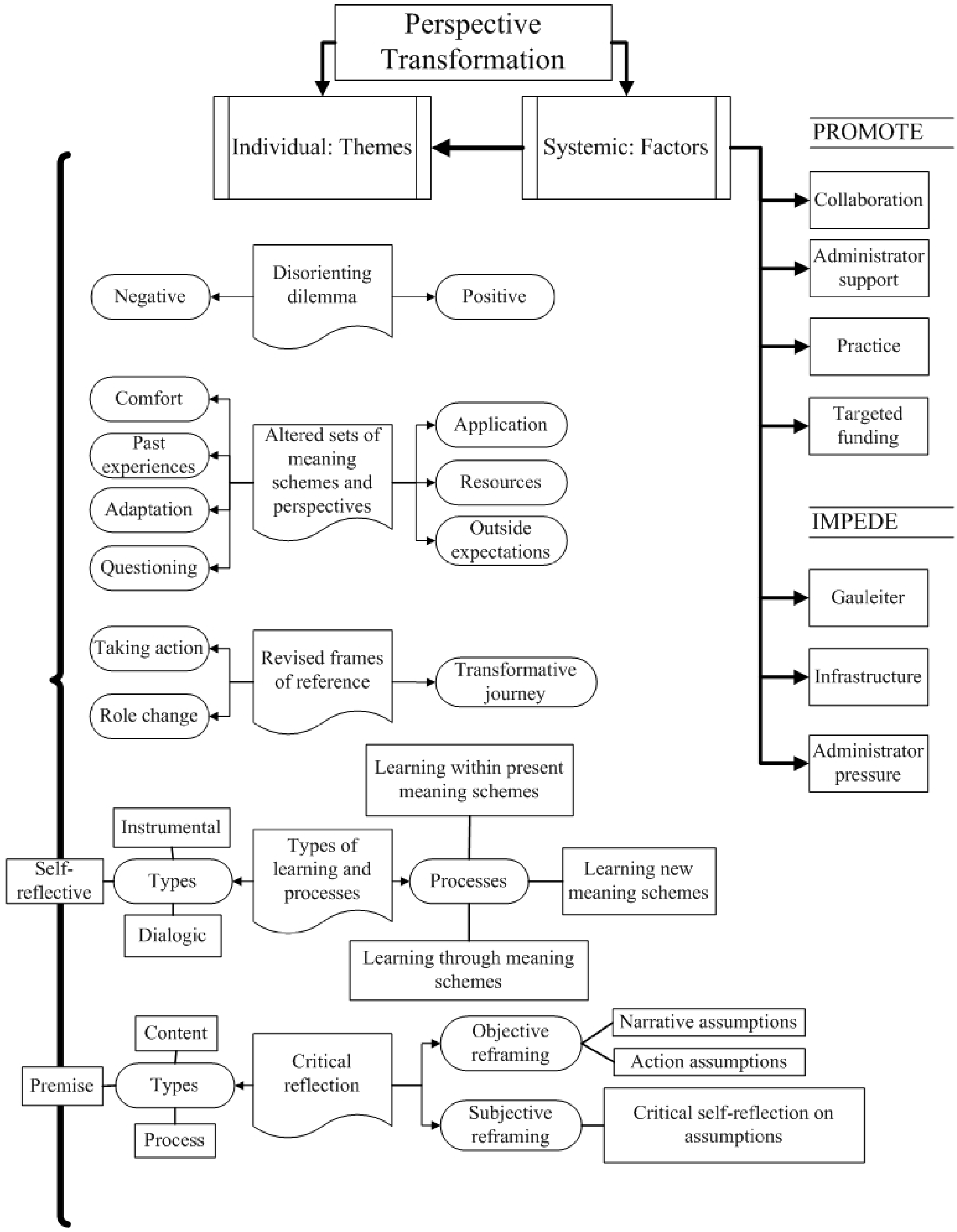


Figure 8: Diagrammatic representation of the individual themes and external systemic factors in perspective transformation

related to this element. A person might also experience *a change in meaning scheme or perspective* which can be manifested in seven different manners so the second theme deals with altered meaning schemes and perspectives (see Figure 8). A *revised* *frame of reference* is also part of a perspective transformation and is described in three forms, based on the data from this study. As a person can experience a *perspective transformation* through one of three learning types and/or three learning processes (see Figure 8), the discussion of this element relates to the participants' comments as they asked how, what, with whom, when, and why they were learning. Lastly, a crucial element of transformative learning, *critical reflection*, is represented in Figure 8, and described in the appropriate theme section, in the form of types ofcritical reflection as well as critical reflection of assumptions and critical self-reflection on assumptions.

All five themes are encapsulated with a large bracket to indicate that each element need not be connected to another element but all five themes are parts of a perspective transformation. As well, there are perpendicular lines attached internally with each theme to show the link to the related sub-themes .

Table 22 provides a tabular summary of the five individual themes and the representative number of comments, extracted from the four data sources, related to each theme.

Table 22: *Summary of the five transformative learning themes and the corresponding number of comments (in raw number)*

Theme	TOTAL
Disorienting dilemma	178
Altered meaning schemes and perspectives	206
Revised frame of reference	278
Types of learning and processes	150
Critical reflection	561
TOTAL	1373

To be consistent with Figure 8, the order of the table is related to the key elements of a perspective transformation rather than to descending rank order from the theme with the greatest number of comment to the least number. The discussion of the themes follows the same order as Figure 8 and Table 22.

For the purpose of discussion, a representation of the respondents' comments will be presented as exemplars. In this manner, rather than provide every response made by the participants, the richest quotes are used.

Disorienting Dilemma Overview

The catalyst for perspective transformation to occur is the disorienting dilemma which

> begins when we encounter experiences, often in an emotionally charged situation, that fail to fit our expectations and consequently lack meaning for us, or we encounter an anomaly that cannot be given coherence either by learning within existing schemes or by learning new schemes (Mezirow, 1991a, p. 94).

In other words, the teachers perceived a mismatch between what they believed and what they were practising in relation to educational technology. Without this disorienting dilemma, perspective transformation does not occur (Mezirow, 1991a). There were many instances of the teachers in this study experiencing a change that caused them to question how they usually acted (178 comments; see Table 22), some (106 of 178 comments) had negative and some (72 of 178 comments) had positive experiences.

Disorienting Dilemma: Negative.

There were four dimensions of negative disorienting dilemmas. That is, something negative occurred that resulted in the teachers questioning their assumptions about educational technology (106 of 178 comments from all teachers).

The first dimension was *hypocrisy* (52 of 106 comments from seven teachers across the three schools). One interviewee, clearly frustrated with the erroneous image of the school as a technologically-progressive school, reported that such "hypocrisy" had changed the way he usually acted, which was to agree with the presentation to the public that School C was a "perfect school" by the Head of School:

> I would say that this school says a lot more about technology than it's ever done. I used to agree with what "we" say to the press and parents but I don't find that I can agree … which I find very dysfunctional (C – 3 interview).

He perceived this contradiction between what the Head of School said the teachers did technologically and what they actually did as a catalyst to change. This distance between the administrators and the teachers, as represented by C – 3's comments, also reinforces the contention that School C's school culture is one of permissive individualism (Hargreaves, 2003). Other teachers in the three schools outlined this hypocrisy dimension, similar to C – 3, in relation to teachers (A – 1; A – 2; B – 1) and administrators (C – 1; C – 2) claiming that more technology was infused than actually occurred and to students being given credit for completing a web-based project when the teacher actually created the projects for the students (B – 2). These experiences led the teachers, ultimately, to acquiring educational technology skills and strategies so that they, themselves, felt that they were upholding the "technology reputation" of their respective schools.

The second dimension of a negative disorienting dilemma was a *contradiction* between self concept and reality (31 of 106 comments from the four teachers in School A). An interviewee described her reasoning for resigning from her computer administrator position, which was contradictory to her nature as a pioneer in generalist teaching:

> I spent one frustrating year being the computer lab administrator for our school. It was a learning time and a frustrating time, as there never seemed to be enough time to learn all I needed to keep the lab running smoothly. One of the most frustrating things was that I didn't feel I got support. The one person that would have known all the answers to anything that I needed to learn was not going to be forthcoming in helping because he was resentful. And when I requested time to have some extra time to work in the lab to work out some of the problems that were going on, it was turned down because it wasn't in line with the principal's way of thinking (A – 4 interview).

Teacher A – 4 described a situation whereby her colleague's and administrator's actions lacked meaning for her as she believed that the colleague would be collegial and the administration would be supportive—neither occurred. Given that A – 4 was in a collaborative school culture regime (see Table 18), it is not surprising that she would have been disoriented with the lack of collaboration from this colleague. This excerpt also demonstrates the relationship between the external systemic factors and the individual themes (see Figure 8 & Table 22) as the two external systemic factors of gauleiter and administrator pressure (see Table 21) are reflected in this individual perspective transformation of a negative disorienting dilemma.

The third dimension of a negative disorienting dilemma was *inner debate* (15 of 106 comments from all participants). The following quote outlined the confusion a teacher felt as she wanted to help her colleagues, and more importantly, the students, by installing software; however, she also realised that the decision would involve more work for her:

> There were lots of experiences. Just negative sort of things…. Well, I would have put CoWriter on the computer. I would have taken it off another computer and put it on the computer they wanted. But then I would be responsible for a kid on that computer. You know what I mean? It's just one more job for me to do. So it's the little things like that that change me (B – 1).

Teacher B – 1 related an experience that could not be given coherence even within her existing meaning schemes (i.e., collegial) or by learning new meaning schemes (i.e., regarding her role and workload as computer administrator). Other teachers in the three schools discussed inner debates on the effort needed for keeping current on computer software (A – 1; A – 4; B – 3; C – 3), on integrating technology in the primary grades (A – 2; A – 3; B – 1), and on meeting the curricular outcomes through educational technology (A – 1; B – 2; C – 1; C – 2). This dimension of inner debate caused each of the 10 participants to take action in their educational technology professional development.

The last dimension of negative disorienting dilemma was a perceived *lack of equality and respect* (8 of 106 comments from the three School C participants). The teachers wanted to be treated the same, and with respect, across the grades rather than preference being given to specific grades. One interviewee, C – 1, stressed that she knew the potential that the students could reach with effective technology instruction as she saw the high school students create sophisticated projects, and became "angry that I would never be able to do it until the [Head and Deputy Head] respected [the teachers in the Junior School] as teachers of technology" (C – 1). She went on to expand her initial interview comment:

> This is the first time in my long career that I have actually had to work hard at enjoying teaching, and I am fast losing patience with the group as a whole. I am usually very optimistic and positive about classes and their potential. But this year, I actually have to force myself to teach. And I feel very ineffective because of the favouritism in the school (C – 1 interview).

In other words, her normal behaviour was to be progressive and cutting edge in her teaching but the experience of seeing the high school teachers using expensive and sophisticated software with their students while the elementary school teachers were given very little time and technology to use with their students, caused her to decide that technology diffusion was not worth attempting with her students if there would be no administrator support. She also came to the conclusion that she had been disrespected by the Head and Deputy Head of School as they did not see the Junior School teachers as technology teachers and was becoming disheartened to the point of resignation. Her two colleagues reiterated this perceived inequality and disrespect as they discussed the administrator preference given to the Senior School (C – 3) and the expectation that the Junior School teachers contribute their own software and hardware to the classrooms "if they wanted to use technology more often" (C – 2 interview). The emphasis on the lack of administrator support reinforces the previous argument that systemic factors that impede or retard perspective transformations are related to a lack of administrator support and the culture of the school—in this case, the permissive and corrosive individualism (Hargreaves, 2003) of School C.

These four dimensions of negative disorienting dilemmas demonstrate that the catalyst for change need not be positive in nature. The fact that, in this study, negative catalysts outnumbered the positive catalysts indicates that the teachers had experienced a great deal of inner turmoil with educational technology but were willing to continue their transformative journey. Specifically, these data support Mezirow's (1991a) argument that disorienting dilemmas often occur in learning environments that are full of emotion or when we come across a situation that lacks meaning for us.

Disorienting Dilemma: Positive.

Seven participants discussed positive disorienting dilemmas (72 of 178 comments across the three schools; see Table 22 & Figure 8) all of which related to reflection.

One respondent exemplified the importance of reflecting on her development in educational technology:

> I started recording my thoughts and experiences with technology about a month before your study started [i.e., before I asked her to keep a journal but after I had talked to the teachers, asking for volunteers]. I realized that I hadn't really moved very far in some areas and was developing nicely in other areas. When we started working with you, I kept up with the [reflective] journal but I also kept diagrams [see Appendix K] of where I wanted to go. Also, the action plan helped me focus more but it was that inner dialogue, with the diagrams as a way of focussing, that spurred me on (B – 2 reflective journal).

Teacher B – 2 believed that she had made some strides in her technology development but needed to reflect on her learning before and during the study to see the degree of her progress and in what areas she had grown.

After considering his other teaching area, French, and the potential for technology integration in a second language classroom, another teacher informed me that he “saw a really neat French lesson [my other teaching area] by a friend” (C – 3 field note) which convinced him that integrating technology into a second language lesson was a worthwhile goal which led to “the real spur, my ability to think through my learning and realizing that I was intelligent and talented so I could [use technology]” (C – 3 interview). By reflecting on previously-held beliefs and experiences, he saw the potential for some useful second language technology integration but only after he had evaluated his own learning ability. Perhaps regardless of subject area, because of his frustration with external administrator pressure, he did not complete his WebQuest. This will be discussed later.

Positive disorienting dilemmas are important catalysts to begin the transformative learning process but, in this study, did not occur as frequently as the negative disorienting dilemmas (hypocrisy; contradiction; inner debate; lack of equality; and respect). Based on the comments from the 10 participants, reflection, not critical self-reflection, was a key part of this disorienting dilemma. That is, the teachers thought back on what they had learned (e.g., B – 2) or whether they were capable of learning technology (e.g., C – 3) rather than a critical self examination of what needs to be in place for learning to occur, such as their roles in the systemic factors of collaboration, administrator support, time, and targeted funding (see Table 21). This lack of depth of critical self-reflection will be discussed in the last sub-section, “Critical Reflection” and its six related themes (see Figure 8).

Summary: Disorienting Dilemma

In short, the 10 teachers were experiencing their respective disorienting dilemmas as a precursor to perspective transformations (King, 2002a, 2002e, 2003a; LaCava, 2002; Mezirow, 2000). These negative and positive disorienting dilemmas were clearly the catalyst for the perspective transformation as the teachers entered the

"Fear and Uncertainty" phase of transformative learning (King, 2002a, 2002e) (see Table 6, Chapter 1). That is, at this stage, they were starting the process of change which involved changing their meaning schemes and perspectives at a time in their development that often involved difficult decisions and self evaluation (Mezirow, 1978a, 1978b).

Altered Sets of Meaning Schemes Overview

A part of perspective transformation required the teachers to change their sets of meaning schemes or meaning perspective (see Figure 8 and Table 22). That is, they had to have experienced a fundamental alteration in "the structure of cultural and psychological assumptions within which [their] past experience assimilates and transforms new experience" (Mezirow, 1994b, p. 223). Ten teachers provided 206 comments from the three schools. Seven causal sub-themes of these altered meaning schemes (see Figure 8) were derived from the participants' data.

Altered Sets of Meaning Schemes: Comfort.

Four participants commented on how they were initially worried about their existing meaning schemes but eventually became more comfortable with their altered meaning schemes (53 of 206 comments). King (2002a, 2002e) described this stage of self-evaluation and critical assessment of outside influences as "Fear and Uncertainty" (see Table 6, Chapter 1) and this phenomenon was encapsulated in Mezirow's (1978a, 1978b) phases of self-evaluation with feelings of guilt or shame (Phase 1) and a critical examination of epistemic, socio-cultural or psychic assumptions (Phase 3; see Table 1, Chapter 1) . In short, the four respondents were experiencing some level of trepidation as they became more comfortable with their new meaning schemes, meaning perspectives, and frames of reference.

As one teacher, C – 1, thought back on her past role expectations and compared them to her present role, she came to a definitive decision: “I used to resent the time needed for technology and feel guilty but now I accept the time needed as I see the payoff with the students” (C – 1 reflective journal). Another respondent, A – 4, saw her student teachers as contributing to her change in self-perception as someone who was now capable of integrating technology in her Grade One class and subsequently changed her previous belief on the value of technology:

> I used to feel ashamed about how little I used technology. Lately, I have had the pleasure of having Malaspina Education student teachers that have come prepared to do slide shows (KidPix) and PowerPoint [and those] learning opportunities have encouraged me [to be] more enthusiastic and confident about my technology incorporation (A – 4 reflective journal).

The third participant, A – 1, who changed her previous beliefs about technology reflected on her past experiences with technology and her incremental changes as she became more confident during her transformative journey (King, 2002a, 2003):

> Over the next couple of years I gradually made a transition from being fearful of touching a computer (I just knew I would do something to destroy it) to becoming quite efficient at using one. But, it was all discovery, by trial and error (A – 1 reflective journal).

The fourth teacher, C – 2, outlined the importance of learning from watching someone else (Cranton, 1996) in order for her to become more comfortable. This affected her meaning schemes.

> It’s developing more confidence. I really didn’t know what to do and felt somewhat guilty. I just watched other people do it. I watched someone with

> more experience show the students what to do. I watched that and modelled myself after that. So that's how I learned (C – 2 interview).

These four participants commented on how they became more comfortable with their altered meaning schemes. Each of the respondents described some level of hesitation but as they became more comfortable with their new meaning schemes and perspectives, they developed more confidence with technology.

Altered Sets of Meaning Schemes: Past Experiences.

As indicated in the previous chapter, some comments were recorded that dealt with experiences prior to my study (38 of 206 comments from six teachers across all schools); however, they were included as they provided valuable information for the context in which the teachers experienced their perspective transformations. For instance, one teacher, B – 3, discussed the importance of using email which arose out of necessity:

> Then, [our previous principal] came to the school in 1999. He used email for almost all of his communication with the staff. I got into the habit of checking my email almost every day because [he] had information for us. Now I use it daily (B – 3 interview).

It should be noted that her present administrator did not use email as a major communication source, therefore, this participant's taking action and adopting a new way of acting (LAS – PD TECH Statement 11; see Table 15, Chapter 3) was related to her everyday life, outside of school, rather than in the classroom. As well, her participating in this research project reinforced her taking action as she communicated with me and her colleagues via email.

Another teacher used her previous frustration with an "overbearing and manipulative" colleague as a way to take affirmative action:

> It felt like the past lab administrator had liked the power and control over the whole staff that he perceived the job had given. I wanted to change this and the first thing I did [when I became the lab administrator last year] was to ask other staff members to work with me (A – 4 interview).

Additionally, in the process of my research, she learned further valuable technology skills and strengthened the importance of collaboration. This quote reflects the relationship between the external systemic factors of collaboration and gauleiter (see Table 21) and the individual perspective transformation theme of altered sets of meaning schemes (see Table 22 & Figure 8).

These two participants' comments demonstrated the influence of past experiences on altering meaning schemes. For B – 3, she came to understand the importance of email as a communication method ("Now I use it daily") which arose from her previous administrator's expectation that all teachers read their emails ("I got into the habit of checking my email almost every day") while A – 4 assimilated her past feelings for the lab administrator ("the power and control over the whole staff") to transform her own new experiences as a lab administrator ("the first thing I did [when I became the lab administrator last year] was to ask other staff members to work with me"). Teacher B – 1 related an experience that could not be given coherence even within her existing meaning schemes (i.e., collegial) or by learning new meaning schemes (i.e., regarding her role and workload as computer administrator). Other teachers in the three schools discussed their past experiences as they related to professional development workshops (A – 1; A – 2), to colleagues in previous schools (B – 2; C – 1), and to their adult children (B – 2). King (2001) described this type of learner as "building on negative experiences of the past, being frustrated with technology problems, and seeing little application to their work" (p.

64). This altering of meaning schemes caused each of the six participants (A – 1; A – 2; A – 4; B – 2; B – 3; C – 1) to take action and adopt news ways of acting, related to their educational technology professional development.

Altered Sets of Meaning Schemes: Adaptation.

Five teachers discussed the process of adapting their beliefs and strategies to accommodate their altered meaning schemes (30 of 206 comments across three schools).

One interviewee, A – 1, demonstrated this adaptation in her project for this research as evidenced in her reflective journal entry:

> I can see this as a yearly project. Many families do not have cameras, let alone any digital equipment. So it is my gift to them…clips of their children in Grade 3. There is a short video of each child presenting to the class, pictures of all the special events as well as their entire performance at the Christmas concert and Spring Concert. I also import pictures to their files for writing activities; we use WebQuests; complete Internet projects; learn how to use Word 7 and the Student Writing Centre. My Grade 3 class also creates a digital "Newscast" which we copy on to tapes and send home for viewing (A – 1 reflective journal).

She adapted and amalgamated her new skills to create a project about which she was clearly proud.

Another reflective journal entry shows the important element of adaptation as the teacher considered her professional development action plan:

> I spent two hours exploring the possibilities given to us on the "Websites of Note" [an on-line tutorial], hoping to get some inspiration for a topic. Unfortunately, it now occurs to me that the WebQuest design I want to learn is

> going to be much harder than I originally thought. However, I have discovered "Adapting Existing WebQuests" [an on-line tutorial] and am now planning a topic for the spring term with an adapted WebQuest (C – 1 reflective journal).

This teacher also demonstrated knowing one's limits as an adult learner (King, 2003a, 2003b) as she experienced a perspective transformation.

A third reflective journal comment reinforced the idea of adaptation. A – 3 reported that she had experienced

> some type of paradigm shift that made me realize that what I needed to do with [educational technology] is change my beliefs and adapt the tech to what I am doing now with a tweak here and there (A – 3 reflective journal).

This teacher showed the importance of adapting her preconceived ideas to transform her new meaning schemes.

These three teachers were clearly experiencing perspective transformations as they adjusted their sets of meaning schemes and their related meaning perspectives. Additionally, these examples show the linkage between meaning schemes and the three types of meaning perspective (Mezirow, 1991a). The first teacher, A – 1, emphasised the importance of revising her sociolinguistic meaning perspective as she concentrated on language and how it was used in social settings—specifically to produce technological artefacts for the parents and created by their children ("short video of each child presenting to the class, …creates a digital 'Newscast'"). The second participant, C – 1, was revising her epistemic perspective as she discussed how she acquired her technology knowledge ("I spent two hours exploring"), how she re-evaluated that knowledge ("what I want to learn is going to be much harder than I originally thought"), and formed an adaptation to meet her expectations ("now planning a topic for the spring term with an adapted WebQuest"). In other words, she was re-evaluating what she believed she knew and what she actually knew by examining and adapting sample technology projects (e.g., WebQuests). The last interviewee, A – 3, saw the necessity to alter her psychological meaning perspective (“type of paradigm shift”) as she examined the way she viewed her role as a learner and a teacher (Mezirow, 1991a). By recording her thoughts on educational technology and its role in her classroom, she changed her psychological perspective to adapt to her new beliefs about technology to meet her needs in the classroom (“change my beliefs and adapt the tech”).

Altered Sets of Meaning Schemes: Questioning.

In recognising that other people also questioned their beliefs about technology (LAS – PD TECH Statement 4; see Table 15, Chapter 3), four teachers discussed their altered sets of meaning schemes (26 of 206 comments). There appeared to be two sub-themes: questioning others and questioning themselves.

The first sub-theme was questioning others. One of the four respondents, A – 1, captured the essence of a revised meaning scheme through questioning (Mezirow, 1994b) during the semi-structured interview:

> What ends up happening in a school is that a small number of teachers, who want to promote themselves and their fascination with computers, convince parents and administrators (not difficult when computers are the talk of the town) to use money other teachers feel would be better spent on other learning resources (like books) and a staff starts to divide. I feel we need to ask each other why we spend that money (A – 1).

A – 1 recognized that a few teachers at School A were making the argument that technology was useful by using themselves as examples; however, she purported that the other teachers, like her, needed to question the reasoning of spending money and time on computers.

Within the same school, another of the four participants, A – 2, had a different perspective on the shared perceptions of the technology use of her colleagues: “There were times we, as a staff, revisited the idea of creating web pages but I predict many of the staff felt much like I did during my first experiences. Excited at its potential but then what? We all need to ask where we go next” (A – 2 interview). This teacher saw the potential for growth but felt that the staff needed to come together to question each other on what direction needed to be followed.

One teacher from another school, C – 1, shared similar concerns with her colleagues: “I hear many others voicing the same concerns. It is bad when you cannot take part in things in the community because you cannot function the next day in class without getting sick” (C – 1 interview). She perceived the inordinate amount of time and energy devoted to her lesson preparation and delivery to be in conflict with the expectation of extra-curricular activities.

A second sub-theme was inner questioning. One sample journal entry stood out as it demonstrated the inner turmoil experienced by the teachers as they decided on their beliefs about educational technology:

> I have worked hard to establish priorities – I have decided that reading, writing, and math are #1 and everything else [e.g., technology] will need to be integrated and move the children forward in these three areas (B – 2 reflective journal).

This teacher was discussing a changed meaning scheme as “the constellation of concept, belief, judgment, and feeling which shapes a particular interpretation” (Mezirow, 1994b, p. 223). She had experienced an inner turmoil as she tried to marry the feelings of obligation to infuse technology ("[technology] will need to be integrated"), on the one hand, and the resistance to find the necessary time and place in her curriculum to actualise her new way of acting ("establish priorities"), on the other hand. In the end, her specific interpretation was to prioritise the curricular elements and infuse technology as a complement and supplement to her personal, school, and district goals of addressing reading, writing, and math goals. Clearly, she, like the other three participants, had experienced a perspective transformation.

These four participants exemplify King's (2002a, 2002e) "Testing and Exploring" stage (see Table 6, Chapter 1). During this time, there is a great deal of questioning ("Excited at its potential but then what?" [A – 2]) and re-evaluation of one's belief systems ("to use money other teachers feel would be better spent on other learning resources" [A – 1]; "I hear many others voicing the same concerns" [C – 1]; "need to be integrated and move the children forward" [B – 2]) as exemplified by these teachers.

Altered Sets of Meaning Schemes: Application.

Application of one's meaning scheme to daily teaching was evident in three teachers' responses (25 of 206 comments across three schools). In particular, the use and integration of technology in the classroom was important to the three teachers.

This semi-structured interview comment highlighted the causal theme of educational technology application:

> I've used Co-Writer and the reason … the impetus behind that was for my children. It was going to help them with their reading so the child was going to benefit. I would say that's the biggest reason for a new program. And the other idea was [because] I go to lots of in-services to learn new ideas so if I went to a good workshop and I could figure out a way to integrate with what I feel is

> important with the curriculum, then I would. I think that with the Appleworks, this year, I'm just learning how useful it is for making up assignments for the children. Because once you can make a template, then it's so easy to go in and just change it! (B – 2 interview)

As this teacher experimented with creating Appleworks templates and integrating Co-Writer, she built up competence ("I'm just learning how useful it is for making up assignments for the children"), became excited about the facility of using the templates ("Because once you can make a template, then it's so easy to go in and just change it!"), reinforced her relationship with the students ("the impetus behind that was for my children"), and reintegrated the revised meaning perspective (Mezirow, 1978a, 1978b) into her daily life vis-à-vis the continued use of the templates ("I could figure out a way to integrate with what I feel is important with the curriculum").

Two teachers' interview comments further demonstrated the application of meaning schemes. One of these participants reported that she "was excited about applying [her] new knowledge of WebQuests to the students' English projects" (C – 1 interview). This connection of theory to application in the classroom and the accompanying excitement as they altered their meaning schemes was a motivator for further technology integration for these two teachers.

These interview excerpts exemplify King's (2002a, 2002e) "Affirming and Connecting" phase (see Table 6, Chapter 1) and the revision of meaning schemes. During the "Affirming and Connecting" stage (2002a, 2002e, 2003b), teachers will make new connections between technology and their teaching, become excited about their own learning, and apply their learning to their students' learning. As well, it reflects Mezirow's (1978a, 1978b) original transformative learning phase of building of competence and self-confidence in new roles and relationships (Phase 9; see Table 1, Chapter 1).

Altered Sets of Meaning Schemes: Resources.

Part of altering and adopting a revised meaning scheme is using resources. Six participants reported that they made the effort to find out sources of information to meet their goal of adopting a revised meaning scheme (18 of 206 comments from Schools A and B).

The approaches were quite varied but consistently related to resources needed to address their meaning schemes:

> Over the years, I have gathered technology resources for my toolbox [that] have made my life easier [so] I have implemented a number of technology "ways" in my teaching (things students participate in). These include: PowerPoint; WebQuests; software programs like Student Writing Centre, Word, etc.; video editing; scanning pictures; webpage; use of Internet; email; working on finding a way to use Kidpix) (A – 1 reflective journal).

> I'm not wasting my time anymore. The kids suffer, so, if I know the teachers want to learn something to help their kids (especially special needs), I will find the resources, learn them, and share them with the teachers (B – 1 interview).

> I knew that I needed to find resources so you were the best person. The KidPix desktop thing helped me and the websites from real teachers did too…. (A – 4 interview).

> After much experimentation, I have found the information I need to succeed [in educational technology]…. I am using programs such as Student Writing Centre and Kid Pix as a venue for the students to show what they have learned after a particular study. That sort of result makes me want to go out and learn more and more [and] I am getting better at finding the necessary information (A – 2 reflective journal).

> So in my experience, it was very important. I don't think that without the opportunity to have talked to you over the telephone and to have had that immediate response with the email, I think I would have gotten stumped and I would have walked away. But because I was able to get the answers to those questions so quickly, I was able to carry on and continue. So, I think it was very, very important (A – 2 interview).

These revised meaning schemes have resulted in a revised meaning perspective which, in turn, led to a perspective transformation. Clearly, a major strategy for the teachers is to gather pertinent information, such as independently learning computer programs or having me assist them in learning a program with just-in-time intervention, was crucial. As well, the absence of comments from School C in relation to this sub-theme of application is indicative of their corrosive individualism school culture (Hargreaves, 2003) as the Junior School teachers were mandated to use the present resources and of their lack of time (see "Professional Development Action Plans," Chapter 2).

Altered Sets of Meaning Schemes: Outside Expectations.

As part of the altering of meaning schemes and perspectives, five teachers became aware of how uncomfortable they were with the traditional social expectations of teachers (LAS – PD TECH Statement 6; see Table 15, Chapter 3). In particular, three interviewees expounded the frustration of what is expected from outside the school (e.g., Ministry of Education curricular changes; practice time; parents' perceptions) versus inside the school (e.g., teaching children) (16 of 206 comments across three schools). One teacher, A – 1, commented:

> But I just worry what's coming out of the curriculum. And, in a school, it's nice if you can say, "Okay, in Grade 5, they're really good at this [hardware application] so they don't get a lot of that; in Grade 3, they're really good at that [software application] so they don't get a little bit of that." But that's not what we're expected to do as teachers (A – 1 interview).

Another, C – 1, echoed the sentiment:

> And it's not that I don't want to learn the technology, but I know going into it, that it's not going to be something that you can do in 15 minutes. I find that in this school, I don't have much more than 15 minutes …. But it does require massive amounts of time [at home to learn the programs], you know. (C – 1 interview)

Another, C – 3, expressed her frustration with being expected, by parents and administration, to use, integrate, and teach technology at a comparable level to her colleague:

> It's a faulty model of technology to say that we're doing technology at our school because of what [the Junior Head] does with the kids. It looks good to [parents] that their children create sophisticated projects. [It] makes me

> uncomfortable that [parents and administration] expect me to perform at that level (C – 3 interview).

These three teachers were, in effect, describing various distortions in their epistemic, sociolinguistic, and psychological meaning perspectives (Mezirow, 1991a) through the use of critical discourse (Mezirow, 2003).

Epistemically, five of the teachers re-evaluated what they believed they knew and what they actually knew about the social expectations of a teacher ("But that's not what we're expected to do as teachers" [A – 1]; "You no longer can teach the 3 Rs without considering technology" [A – 2]), sociolinguistically, what specific language would be used in particular settings of a computer lab or classroom ("[It] makes me uncomfortable that [parents and administration] expect me to perform at that level" [C – 3]; "You need to know the lingo as well as the skills" [B – 1]), and, psychologically, what they perceived about their own ways of learning ("I find that in this school, I don't have much more than 15 minutes …. But it does require massive amounts of time [at home to learn the programs], you know" [C – 1]) through critical analyses.

Summary: Altered Sets of Meaning Schemes

It is clear from the myriad examples that the theme of altered meaning schemes was present in the participant comments (see Table 22 & Figure 8). All 10 teachers described a clear change in the formations of concepts, beliefs, judgements, and feelings which shaped their particular interpretations (Mezirow, 1994b). Some teachers did not experience all seven sub-themes of altered meaning schemes but each teacher experienced at least one of the sub-themes.

Revised Frames of Reference Overview

The transformative learning element of a revised frame of reference, comprised of a series of habits of mind and the resulting points of view (Mezirow, 1978, 1981, 1985, 1991, 2000), was a clear theme within the data (see Figure 4, Chapter 1 & Table 22, this chapter). That is, "the structure of assumptions and expectations through which we filter sense impressions … [which] provides the context for making meaning within which we choose what and how a sensory experience is to be construed and/or appropriated" (Mezirow, 2000, p. 16). The participants in this study described several revised frames of reference which were made up of their filters, or habits of mind, and their meaning-making contexts, or points of view (Mezirow, 2000).

All 10 teachers reported taking action and adopting their revised ways of acting (LAS – PD TECH Statement 11; see Table 15, Chapter 3 & Figure 8, this chapter) in relation to educational technology (102 of 278 comments across three schools). Every participant discussed their change in role (LAS – PD TECH Statement 7; see Table 15, Chapter 3 & Figure 8 in this chapter) as a result of their revised frames of reference (98 of 278 comments across three schools). Seven described a transformative journey (78 of 278 comments across three schools) (see Figure 8).

Revised Frames of Reference: Taking Action.

Teachers discussed their taking action (102 of 278 comments) through utilising present resources (B – 2), working with another colleague (B – 1), learning a particular software program (A -1; A – 3; B – 3; C – 1), attending specific ICT workshops (A – 2; C – 2), and acquiring the skills to be a lab administrator (A – 4; C – 3).

Taking action using a revised frame of reference was particularly significant for one teacher as she recorded in her reflective journal:

> I decided to use technology as a tool to further develop my reading, writing, math goals or learning outcomes and job. I realized that I don't need a computer lab to teach technology. Two classroom computers and the four neighbourhood computers were fine (B – 2 reflective journal).

This particular teacher had consistently reported her trepidation in using technology as she had spent a great deal of time previous to this research study learning programs and approaches only to not use them. When she made the conscious effort to try something different, she became more confident and experimented more. Ultimately, she decided that much of her technology use, integration, and teaching could occur in the classroom rather than in the computer lab—despite the fact the lab was state of the art and frequently vacant. This understanding that her technology learning was guided for application on a daily basis, that content and application of knowledge are connected, and that she had the opportunity to apply knowledge gained after professional development opportunities (i.e., a workshop provided by me) are to "learn for action" (Lawler, 2003, p. 19) which is an important adult learning principle.

One extended interview excerpt demonstrates several of the stages of transformative learning—most notably a revised frame of reference—culminating in definitive action:

> I was starting to get bitter about fixing teachers' computers when they didn't really want to learn how. Then I had an experience that perked me up. I actually connected up with another teacher, Jane X, who is the SET-BC [Special Education Technology – British Columbia] person. I don't have any SET-BC kids that are low but she knew that I was using Clicker 4 for your

> project [as a language augmentation tool for language-delayed and language-impaired students] and I showed her when she was down for one of our other students. And she couldn't believe what I've done with bringing in all the images but I use the word processor part, not so much the frame part. And this other lady who is a Speech and Language Pathologist [at another school] came over to sit in on the [SET – BC] workshop. And, it's great. The more the merrier! Let's all share. Turns out that she is quite the expert on the templates—-the one where they type in and they shoot up. And she didn't realize that it worked the same way that IntelliTalk worked. Like she couldn't believe that it spoke. And she's been using it for years. She said, "I'm been using it for years and I didn't know." So she is an expert there and I'm an expert here. Now we can connect and share that part of it. It's nice to find other people like that. (B – 1 interview).

The teacher was able to describe an experience that caused her to question the way she acted ("I was starting to get bitter about fixing teachers' computers when they didn't really want to learn how") as well as her ideas about social roles (what being an expert means), experiment with the new role (being in the position of learner rather than teacher as she learned features of Clicker 4), show that she gathered the necessary information to adopt the new role (learning from and liaising with other experts), use the reactions and feedback (from Jane X and the Speech and Language Pathologist), and take action to form a new frame of reference, using the newly-acquired Clicker 4 skills which was her professional development goal, as she filtered through her assumptions about learning and teaching. As well, her comments highlight the relationship between the external systemic factor of collaboration (see

Table 21 & Figure 8) and the individual perspective transformation of a revised frame of reference (see Table 22 & Figure 8).

For these two teachers, in particular, and for the other eight teachers in this study, in general, taking action to revise their frames of reference led to perspective transformations. In varying degrees, this initial action led to further exploration and experimentation with educational technology which, in turn, led to a deeper degree of perspective transformation.

Revised Frames of Reference: Role Change.

All 10 participants reported a change in role (98 of 278 comments across three schools) related to their changed frames of reference. Two teachers commented on their becoming a manager of time (C – 1; A – 2), three discussed their roles as learners (A – 3; B – 3; C – 2), two expressed a role change to a technology facilitator (B – 1; A – 4), and three participants outlined their role change to technology evaluator (A – 1; B – 2; C – 3). For the purpose of explanation, one example for each role change will be presented from the research data.

One teacher's revised frame of reference and the related philosophical habit of mind was evident in her comments. She re-evaluated her structure of assumptions and expectations about and for technology to arrive at the conclusion that her role has changed.

> I have had several experiences in the past couple of months that have caused me to question my role as a teacher, specifically how I teach with technology. This year I have had many [educational technology] lessons that I felt were underwhelming to say the least! (C – 1 reflective journal).

This teacher appeared to feel passionately about how her role had markèdly changed from a teacher to a time manager due to the school demands, associated with technology, placed on her from the administrators.

Another, A – 3, made a distinction between her role as a colleague and her role as a learner: “So I've a bit of inner conflict going on. I don't want to feel pressured into something because my esteemed colleagues are keen on it, but I do feel pressured…. I know that I should do what they do but I am a different learner than they are” (A – 3 questionnaire). Although she saw the benefits of collaboration, collegiality, and professional development, she did not want to be coerced into altering her psychological habit of mind.

Conversely, another believed that her role changed so she “had to volunteer to support the person that said [she, another person in the school] would take the lead role” (B – 1 interview). Her role had become one of technology facilitator rather than colleague and Special Education teacher which resulted in an altered moral-ethical habit of mind. That is, B – 1 filtered her assumptions through her conscience which dictated that she should assist this teacher. However, B – 1 also felt that her roles should remain as a colleague and a Special Education teacher.

Prior to this study, A – 1, had been contracted to work for the British Columbia Ministry of Education to write curriculum resources in writing. This experience coupled with my research project led her to change her role. She wrote about how she questioned her new role as a technology evaluator:

> Because of this research study, [I felt confident to be] working for the Ministry of Education as an evaluator of learning resources for Language Arts. I received training on how to evaluate electronic resources and that gave me

> confidence deciding what resources were actually worthwhile spending the time and money on (A – 1 reflective journal).

This experience assisted her in gaining more expertise and more confidence and resulted from her change in an epistemic habit of mind. She realised that her learning style was accommodated (Mezirow, 2000) as she needed the background knowledge in educational technology, acquired in my hands-on workshops, to feel more confident to become a technology resources evaluator.

These four exemplars are representative of all 10 teachers' comments and demonstrate what Mezirow (1981) defined as a perspective transformation which resulted from a revised frame of reference and its related habits of mind:

> … the emancipatory process of becoming critically aware of how and why the structure of psycho-cultural assumptions has come to constrain the way we see ourselves and our relationships [and] reconstituting this structure to permit a more inclusive and discriminating integration of experience and acting upon these new understandings (p. 6).

C -1 described how she was becoming critically aware of how the psycho-cultural assumptions of being a teacher had constrained her perception of herself as a teacher ("caused me to question my role as a teacher"). A – 3 and B – 1 discussed the same constraints as they pertained to their relationships with colleagues ("feel pressured into something because my esteemed colleagues are keen on it" and "had to volunteer to support the person that said [she] would take the lead role"). Finally, A -1 clearly described how the structure of psycho-cultural assumptions had been reconstituted and led her to an integration of experiences ("that gave me confidence deciding what resources were actually worthwhile spending the time and money on").

Revised Frames of Reference: Transformative Journey.

Seven participants described a transformative journey (78 of 278 comments across three schools) as a result of their revised frames of reference. The next excerpt, as an exemplar for all seven teachers, outlines the six changes that occur along a "journey of transformation" (King, 2002a, p. 161) (see Chapter 1) resulting in a revised frame of reference. In order for a perspective transformation to occur, King (2002a) argued for the presence of the following: a clear emphasis on self-directed learning, use of new teaching methods, incorporation of critical thinking skills development in learning, employing problem-based learning, preparation and research, and confidence and empowerment of teachers and learners.

> When we were making the webpages, we wanted to learn at our own rate [and] we wanted to be able to use you, only when we couldn't get it ourselves. So we would try and work it out between the two of us first. Like finding good websites on the Internet. And then we would take it to another level, which would be emailing you. I think that was a really important part of me getting where I got to [and] a big part of feeling so successful (A – 2).

This teacher utilised self-directed learning as she set her own pace for mastering the skills ("learn at our own rate"), used a new teaching method ("making the webpages"), incorporated critical thinking and problem-based learning into the process by using my expertise only as a last resort ("we wanted to be able to use you only when we couldn't get it ourselves. So we would try and work it out between the two of us first"), and by collaborating with another teacher (A – 1), prepared and researched websites for construction ideas ("Like finding good websites on the Internet"), and ended with a great deal of confidence and empowerment ("a big part of feeling so successful") (King, 2002a, 2003).

Like A – 2, the other participants' revised frames of reference related to an emphasis on self-directed learning ("I wanted to learn the technology at my own pace" [A – 3]), acquiring new teaching methods ["I have increased my repertoire of teaching educational technology during this study" [C – 1]), using critical thinking ("I set myself a critical challenge and addressed it with a specific set of technology tools" [C – 2], employing problem-based learning ("I identified the technology [issue] problem and kept up with finding the answer" [A – 1]), preparation and research ("I looked for the solutions, using your resources and Google" [B – 2]), and confidence and empowerment of teachers and learners ("I feel so confident. Like I could take on any technology challenge now" [C – 2]). Ultimately, they came to the realisation that their respective learning paradigms needed to be adjusted to ensure success in their technology professional development.

Summary: Revised Frames of Reference

The participant comments from this chapter section reinforced the theme of a revised frame of reference (see Table 22) and its related sub-themes of taking action, role change, and a transformative journey (see Figure 8) as they described situations in which they were faced with a problem and had to rely on a community of learners to arrive at a reasonable solution. In other words, they posited many answers to a series of educational technology questions but agreed on set solutions by discussing the possibilities with their peers and adjusting their respective habits of mind (Mezirow, 1985, 1991, 2000).

Types of Learning and Learning Processes Overview

The transformative learning element of learning types and processes was another clear theme (see Table 22 & Figure 8 [types and processes]). There were six distinct sub-themes, divided by type and process: (1) instrumental learning (type; 15 of 150 comments), (2) dialogic learning (type; 22 of 150 comments), (3) self-reflective learning (type; 29 of 150 comments), (4) learning within present meaning schemes (process; 18 of 150 comments), (5) learning new meaning schemes (process; 26 of 150 comments), and (6) learning through meaning schemes (process; 40 of 150 comments) (Mezirow, 1985, 1994b) (see Figure 8).

Types of Learning: Instrumental Learning.

The searching out of learning in a systematic manner is *instrumental learning* (15 of 150 comments) (Mezirow, 1985) as demonstrated by five participants from Schools A and C. The three participants from School B did not demonstrate instrumental learning which was not representative of their school culture of performing training sects and its emphasis on prescribed curriculum (Hargreaves, 2003). In other words, the School B teachers did not attempt to adopt a systematic method of acquiring educational technology skills even though their school culture epitomised a learning environment that encouraged rote learning vis-à-vis the prescribed teaching strategies.

Two teachers, C – 1 and A – 2, had investigated two technological artefacts, WebQuests and PowerPoint, respectively: “I did the evaluation of some existing WebQuests” (C – 1 questionnaire) and

> I started by opening PowerPoint and selecting a new page. I picked a format and gave it a title, "Let's Learn About the Coldest Places on Earth". I was able to change the background colour, add clip art and change the font. It looked great (A – 2 interview).

They initially asked themselves the best way to acquire the necessary information about WebQuests and PowerPoint (instrumental learning) and, thereby, started the learning process.

A third participant, A – 4, indicated in her reflective journal that the research study

> made me aware of how much what I did with tech impacted the students…. I went step by step to make sure I followed the tutorial you gave me…As [the students] gave me feedback, I wanted to do it more" (A – 4 reflective journal).

With her emphasis on rote learning which was governed by rules ("I went step by step to make sure I followed the tutorial you gave me"), A – 4 exhibited instrumental learning.

The final two participants, C – 2 and A – 3, expressed their reticence about educational technology in a forthright manner in their reflective journals: "So, really I have never felt confident or comfortable with computers … so I need to take baby steps" (C – 2 reflective journal) and "I'm content with small steps, and not too many too fast" (A – 3 reflective journal). Clearly, they demonstrated instrumental learning as they needed to proceed in a slow and rule-governed process.

C – 2 and A – 3 also reflected the argument that transformation is gradual (Mezirow, 1981, 1994b) and that not all learners move beyond one or two phases, at least in the short term such as a workshop or conference. The first teacher, C – 2, never moved beyond that feeling of reticence as she was more concerned with instrumental (i.e., rote and rule-governed) rather than dialogic (i.e., social norms and the best way of meeting those norms) and self-reflective (i.e., introspective) learning (Mezirow, 1985, 1994b; see Figure 8). The other respondent, A – 3, proved, through her semi-structured interview comments three months later, that she had become much more comfortable with her learning educational technology: “I feel that I can think more about why I use [educational technology] rather than worry about whether I am doing it by the rules” (A – 3 interview). She rationalised her new meaning perspectives by directly dealing with the previous feelings that were associated with the original meaning schemes and therefore ensured that perspective transformation occurred through self-reflective learning (Mezirow, 1994b).

These five teachers searched out learning in a systematic manner, using a scaffolding (C – 1; A – 2) or step-by-step approach (A – 4; C – 2; A – 3), and therefore demonstrated instrumental learning (Mezirow, 1985).

Types of Learning: Dialogic Learning.

Three teachers from Schools A and C demonstrated dialogic learning (Mezirow, 1985) (22 of 150 comments). Using this learning type, the participants decided when and where their learning could best take place (Mezirow, 1985).

A - 2 and C – 1 continued their professional development in learning WebQuests and PowerPoint, respectively, and reported in their interviews: “I tried to think about [what] I wanted the presentation to accomplish or how I would use it” (A – 2 interview) and “I reasoned that if I checked what others did, I could decide what I liked or could use” (C – 1 interview). This examination reflected dialogic learning as they searched for the best avenue for implementing the investigation (Mezirow, 1985).

The third participant, C – 2, wrote in her reflective journal about her experiences with her students and their expectations:

> I am also aware that students enjoy learning using technology so it makes my job easier. And they expect technology to be something I teach them or they

> use [so] I look for the best way to meet those expectations (C – 2 reflective journal).

By stressing the importance of social norms ("And they expect technology to be something I teach them or they use") and by seeking the best method to meet those norms ("I look for the best way to meet those expectations"), C – 2 demonstrated dialogic learning.

These three teachers saw the need to acquire further information to support their technology development. They worked out the best way to obtain the necessary skills (C – 1; A – 2; C – 2) while meeting their own or others' expectations. Once again, there was no representation from the School B participants. This lack of comments was indicative of their school culture of contrived collegiality (Hargreaves, 2003) as the thrust for technology infusion across all grades had been initiated by the previous administrator and was kept up very minimally by the present administrator and by the other staff members. However, the lack of comments was contrary to the actions of the three School B participants in my study as they kept up their technology infusion quite conscientiously which was contrary to their school culture contract of performance learning sects which occurs when groups of people place a clear emphasis on highly-prescribed curriculum rather than on effectively teaching the students (Hargreaves, 1994, 2003).

Types of Learning: Self-reflective Learning.

Four teachers, from all three schools, demonstrated self-reflective learning (Mezirow, 1985; see Figure 8) (29 of 150 comments) as they became introspective and/or searched for further answers to their questions about educational technology.

Besides their dialogic learning comments, C -1 and A – 2 evidenced self-reflective learning (Mezirow, 1985):

> After debating the pro’s and con’s of the making WebQuests, I feel somewhat qualified to come up with something workable. It constantly amazes me the complicated projects that people come up with but I found a great deal of [helpful] answers at those websites” (C – 1 interview).

> But then what???... so I decided to create something I could use to introduce the unit based on what I found at the websites [that you gave us in the workshops]. … I also considered the good and bad of the WebQuests” (A – 2 interview).

In other words, they sought the reasoning for understanding the advantages and disadvantages of the pedagogical tool, WebQuests (self-reflective). This critical inner discourse was paramount in their transformative learning process (Mezirow, 2003).

As well, A – 2, recorded a longer response in her reflective journal related to learning how to make webpages for primary teachers:

> While looking for pictures to add to the [webpage] project I stumbled across other web pages created by primary teachers. I realized that was something that would really work for me…. That sort of feedback is useful to me as it comes from students and teachers who have actually used it (A – 2 reflective journal).

With her introspection, A – 2 showed self-reflective learning (“I realized that was something that would really work for me…. That sort of feedback is useful to me as it comes from students and teachers who have actually used it”) (Mezirow, 1985, 1994b).

A semi-structured interview comment further strengthens the argument for A – 2’s self-reflective learning in relation to educational technology:

> I really believe that I have changed now from what I used to believe my role as a teacher was. I think I get more of what I really want and need to best meet the learning outcomes for the students in my class. I also believe that technology has made me a better communicator to the parents of the children in my class. I find myself sending home more correspondence due to the ease, quickness and quality of the documents I can produce in a word processing program. I have also been experimenting with an online newsletter and calendar of events on my web page (A – 2 interview).

This teacher has come to the realisation that educational technology has not only changed her daily teaching life but also has led to a change in role (revised frame of reference) so that she perceives herself as a better communicator because of her educational technology use.

Only one teacher from School B commented on self-reflective learning as she discussed her professional development action plan:

> As I learned more and more about Clicker 4 in the classroom, I came to realise that my problem had not been technological but rather philosophical. Once I cottoned on to the purpose of Clicker 4, I was able to buy into its use in my Learning Assistance classroom and make the argument to teachers that my Special Education students could use it in their classrooms (B – 1 interview).

This teacher realised that she needed to get past the mechanics of learning the software program and reflect on why she wanted to use it in her Learning Assistance classroom and why she wanted to encourage her colleagues to use it in their respective classrooms with Special Education students.

Summary: Types of Learning

These examples, representative of those responses from all 10 participants, demonstrated Mezirow’s (1985, 1994b) three types of learning as it was evident that the six representative teachers (A – 2; A – 3; A – 4; B – 1; C – 1; C – 2) asked themselves how they could best learn the necessary skills (instrumental), in what context this learning could take place (dialogic), and the purpose of learning the information (self-reflective; see Figure 8). As well, their representative comments supported his later argument that communicative learning, involving analogic-deductive logic (i.e., reasoning from concrete example to abstract conceptualisation) was a critical element of transformative learning (Mezirow, 2003). Thus, they moved from concrete examples of educational technology to the abstract concepts of becoming better at their jobs through educational technology.

Types of Processes: Learning Within Present Meaning Schemes.

In addition to the three learning types, there was evidence that learning processes were present in the data (84 of 150 comments).

The responses from two participants highlighted learning within present meaning schemes (18 of 150 comments from School A) as they worked with what they knew and acquired skills within their pre-determined set of [technology] assumptions (Mezirow, 1985; see Figure 8). One teacher, A – 2, needed to use the assistance of a mentor or a more capable person to learn educational technology skills:

> But I do think that the more I learn, and the more competent I become, maybe a little bit less reliant on having someone there. I think that mostly when I was first learning, I needed those questions answered right away. I think I am

> better now at solving, investigating, taking things on, and giving them a try on my own now (A – 2 interview).

Her colleague, A – 1, indicated that she “worked with the skills [she] had and tried making [curricular] improvements with those rather than getting more skills” (A – 1 reflective journal).

These two teachers exemplified Mezirow’s (1985) learning within present meaning schemes (“I think I am better now at solving, investigating, taking things on, and giving them a try on my own now” [A – 2]; “worked with the skills [she] had” [A – 1]) as they acquired a new set of skills within the pre-determined paradigm of their assumptions for learning (“the more I learn, and the more competent I become” [A – 2]; “tried making [curricular] improvements with those rather than getting more skills” [A – 1]).

The two teachers’ comments also reflect the connection between the external factors related to perspective transformations and the individual perspective transformation theme of learning processes. School A was characterised as a professional learning community contract (Hargreaves, 2003), had a supportive administrator, and used targeted funding (see Table 21) to assist them in their educational technology development. These external promoting factors allowed the teachers the opportunity to acquire their learning without a great deal of pressure from outside sources.

Types of Processes: Learning New Meaning Schemes.

Three participants, one from each school, discussed learning new meaning schemes (26 comments) as they used what they already knew as a foundation for learning but acquired new meaning schemes to better utilise educational technology in their schools (Mezirow, 1985).

One teacher, B – 3, reported, in her semi-structure interview, her feelings on the potential for using a digital video editing software program:

> I knew how to use iMovie quite well but I also knew that I could learn more which is why I chose it for the action plan. When I built on what I knew and experimented more and more, I realised that I hadn't even scratched the surface with what I could do with my students in the lab. Their Space projects are the best I've ever seen because of the cool things they did with iMovie (B – 3 interview).

She recognised what she knew about iMovie but realised that there was much more to learn. She built upon that initial knowledge to acquire a new set of meaning schemes and was impressed with what the Grade Six students could do with the software program.

Another teacher, C – 1, recorded her feelings on the computer layout in her classroom and school in her reflective journal:

> None of us were using computers. … [At another school I know], what they did was they put a bank of 6 computers in the staff room. People used them and they taught each other. So I think that's a good plan. Don't re-create the wheel and build on what you know. I and others have adopted [that layout] in the classrooms with 1 or 2 computers. In the staff room, with 2 computers, teachers help each other on the computer (C – 1 reflective journal).

For this teacher, C – 1, adapting what she knew worked elsewhere ("they put a bank of 6 computers in the staff room. People used them and they taught each other") was important as the act caused other School C teachers to use computers more often in the staff room and, in the case of C – 1 and C – 2, in their respective classrooms. As well, she perceived collaboration and peer teaching as fundamental for adopting new ways of acting (LAS – PD TECH Statement 11; see Table 15, Chapter 3) which reinforces the relationship between the external systemic factor of collaboration (see Table 21) and this individual perspective transformation theme of learning new meaning schemes (see Figure 8).

The third teacher, A – 1, commented on one of her professional development action plan goals:

> I had a basic understanding of how to use PowerPoint since I had done a few presentations for the [Ministry of Education] but knew, from watching what you did, that there much more to learn. I … tried some projects with old teaching units to jazz them up, and eventually, acquired a whole new set of skills that were pretty damned impressive! (A – 1 interview).

This teacher had a good foundation of knowledge about the software program but recognised that there was more to learn. She built on her present meaning schemes by learning a new set of meaning schemes.

These three teachers demonstrated Mezirow's (1985) learning new meaning schemes ("When I built on what I knew and experimented more and more, I realised that I hadn't even scratched the surface with what I could do with my students in the lab" [B – 3]; "I and others have adopted [that layout] in the classrooms with 1 or 2 computers. In the staff room, with 2 computers, teachers help each other on the computer" [C – 1]; "eventually, acquired a whole new set of skills that were pretty damned impressive!" [A – 1]). They worked with their existing schemata as a basis for learning but integrated new meaning schemes, increasing knowledge of iMovie, re-arranging computers to maximise learning, and adding to present skills with PowerPoint respectively, to augment their educational technology development.

Types of Processes: Learning Through Meaning Schemes.

According to Mezirow (1978a), discontent usually leads to transformative change (Mezirow, 1978a). The following five teachers were learning through meaning schemes (40 comments across three schools) as they became "aware of specific assumptions (schemata, criteria, rules, or repressions) on which a distorted or incomplete meaning scheme is based and, through a reorganization of meaning, transforming it" (Mezirow, 1985, p. 23). In other words, the five teachers were presented with a situation which could not be resolved within through present meaning schemes or by acquiring new meaning schemes, so they restructured to schemata to make meaning.

One teacher described her ire at another teacher, which resulted in a change in her point of view and in her role in the school:

> It was my feeling that we were being held hostage in our school over the computer lab [because] my skills were so low. The person who had previously done it, looked after the lab, there was no one else who could [do it] and so the threat was "Give me what I want or do what I want; treat me how I want OR I am not going to do this for you." And that aggravated me! (A – 4 questionnaire).

The threat aggravated that teacher to the extent that she began thinking about changing her role to include the computer lab administrator position (which was a fundamental change in role and was eventually put into action). This course of action necessitated her acquiring more educational technology skills. In particular, A – 4 became aware of repressions of frustration with her colleague and of low confidence of her abilities and reorganized her meaning schemes to include the possibility of changing her role to be a computer lab administrator. The excerpt also reflects the connection between the external systemic factor of a gauleiter (see Table 21) and this individual perspective transformation theme of learning through meaning schemes (see Figure 8).

Another teacher, C – 2, described how she questioned her learning type and process by watching other, more competent, teachers integrate technology:

> I thought that I couldn't learn without actually following step by step [on my own computer. However,] I just watched other people do it. I watched someone with more experience show the students what to do. The more I watched, the more I believed that I could [use technology] (C – 2 interview).

She described her set of assumptions about technology and the rules for learning it ("I thought that I couldn't learn without actually following step by step [on my own computer]" so that she was able to perceive herself as confident in using educational technology ("The more I watched, the more I believed that I could [use technology]").

Lamenting the fact that they learned new skills as part of their professional development and yet could not implement those skills was apparent in the comments of two interviewees, C – 1 and C – 3:

> What frustrated me though was learning how to do it and then not doing it. Not going back to it but it just seemed a case of priorities [with] limited time. It just went to the bottom of the list (C – 1 interview).

> If I could [have the software and hardware], I would sit down and find ways that we could get the kids on them and use them more. In light of the fact that it's not the case, I simply haven't done it (C – 3 interview).

They outlined their transformed meaning schemes, based on their assumptions about specific criteria for using technology, as they related to finding the time ("it just seemed a case of priorities. It just went to the bottom of the list" [C – 1]) and the actual computer equipment ("If I could [have the software and hardware], I would sit down and find ways" [C – 3]) to use technology in their respective classrooms.

The fifth teacher commented on her coming to a resolution in assisting her colleagues with educational technology:

> I realised that I was operating on the faulty assumption that they actually wanted to learn. What they really wanted was for me to do it for them without [their] having to learn the software programs. Once I got it, I started working with only the teachers who wanted to learn and who would take the time to learn. Now only three or four teachers use educational technology but they have really come a long way (B – 1 interview).

For this teacher, once she addressed her distorted meaning scheme ("I realised that I was operating on the faulty assumption that they actually wanted to learn"), through a reorganization of meaning ("What they really wanted was for me to do it for them without [their] having to learn the software programs"), she was able to transform the meaning scheme ("Once I got it, I started working with only the teachers who wanted to learn and who would take the time to learn") and arrive at an acceptable interpretation ("Now only three or four teachers use educational technology but they have really come a long way").

Summary: Types of Learning Processes

These eight teachers (A – 1; A – 2; A – 4; B – 1; B – 3; C – 1; C – 2; C – 3) were clearly using their reflection-on-learning and reflection-in-learning (Schön, 1987) to ensure that they adopted their new ways of acting. By examining the process of acquiring knowledge (reflection-on-learning) as well as the processes involved while acquiring the knowledge, skills, and attitudes (reflection-in-learning), the teachers were ensuring that perspective transformation would occur (King, 2003a).

Summary: Types of Learning and Learning Processes

The theme of learning types and learning processes was evident from the participant comments in this chapter section (see Table 22). The teachers demonstrated that they had become aware of the manner in which they were learning educational technology skills, instrumental, dialogic, and self-reflective learning (Mezirow, 1985, 1994b; see Figure 8), perceived alternate ways to learn, and, in most cases, adopted new ways of acquiring educational technology skills using one of the three transformative learning processes (Mezirow, 1994b; see Figure 8): learning within present meaning schemes, learning new meaning schemes, and learning through meaning schemes.

Critical Reflection Overview

The most dominant theme that evidenced in the participant responses was critical reflection and critical self-reflection (561 comments; see Table 22) which “need not be linear, but is a rational process of coming to question habits of mind that become too narrow and too limiting” (Cranton & Carusetta, 2004, p. 289). This section explores how the participants’ comments evidenced Mezirow’s (1995) three types of critical reflection, content reflection, and process reflection (207 of 561 comments; see Figure 2, Chapter 1 & Figure 8, this chapter) as well as critical self-reflection of and on assumptions (see Figures 2 and 3, Chapter 1, and Figure 8, this chapter).

Critical Reflection: Content Reflection.

Thinking back to past experiences is a critical element of content reflection (Mezirow, 1995). Eight participants described their prior experiences (52 of 207 comments across three schools).

One teacher was forthright in her content reflection as she informed me, "I just said, 'You're getting close to retirement and it's time to take some action [with educational technology].' So I did" (C – 1 field note). She thought back to what she had done in her teaching career and realised that she was approaching the end of her teaching days without attempting to learn more about educational technology so she took the action to begin acquiring technology skills by participating in this study.

Another shared her beliefs on acquiring technology skills at a workshop in this way:

> I had been to so many workshops where the presenter took us through the technology and it was great. The problem came when I went to do the work and then it was gone. Poof! … Now, from what you've done with us, I know that we need to have someone who knows their stuff but also that person has to give us a challenge. If I know that someone wants me to do it and gives me the confidence, I will do it (A – 2 interview).

Based on her past experiences, she recognised not only that she needed to have someone to assist her to remember her technology skills acquired at professional development workshops but also that person had to challenge her to go beyond her present level of learning. Her colleague concurred:

> I need to apply the knowledge from past workshops right away. I've come to the decision that I need to just bite the bullet and try whatever I learn…. Then be critical to see if I will try it again (A – 4 interview).

Like A – 2, this teacher perceived the need to take action as soon as possible after learning the educational technology skills and to critically examine the usefulness of those skills.

Three additional comments demonstrate this sort of action, involving thinking back to what was previously (Mezirow, 1995): “I try to reflect right away after a technology lesson” (B – 2 reflective journal); “I tried those sites you showed us and it actually wasn’t so bad [after] I thought of how far I have come since the beginning [of this study]” (B – 3 reflective journal); and “After learning the technology, I found the more I used it, the more I was apt to find what I could use, and toss what I didn’t” (C – 3 interview). In other words, these three teachers described the process of content reflection as they thought back on action that was done in the past to transform their present meaning schemes (Mezirow, 1995).

Reflections on what had happened prior to this study were important to the participants’ content reflection. Four examples stand out:

> I developed confidence and realized that I didn’t have to be a “techy” in order to do a few things on the computer which is how it used to be [before this project with you] (C – 2 interview).

> The one person that would have known all the answers to anything that I needed to learn was not going to be forthcoming in helping because he was resentful [so] I helped myself (A – 4 interview).

> When I reflected on all I had learned with you, I felt quite comfortable. I have come a long way [when] I consider what I have learned since we first started

> working together on our action plans and then started the workshops (C – 1 reflective journal).

> Six months prior to this study, I really felt powerless. When I was able to feel that I had some power and control over what I wanted to learn and learning about what I needed to learn for my students and for myself, then I felt more positive towards them or less negative about computers. And it was probably when I realized my influence on my students—my positive or negative influence—was when I realized how empowered I had become (A – 2 reflective journal).

In essence, these participants were exhibiting *authenticity*, an important part of critical reflection, as they expressed their "genuine self in the community" (Cranton & King, 2003, p. 33) in their efforts to become more confident ("I developed confidence"[C – 2]), more at ease ("I felt quite comfortable"[C – 1]), and more affirmed in their new roles ("I helped myself" [A – 4]; "I was able to feel that I had some power and control over what I wanted to learn" [A – 2]).

The process of thinking back to what was done in the past (Mezirow, 1995) led to a change in role for several participants (LAS – PD TECH Statement 7; see Table 15, Chapter 3). One teacher, A – 4, said that she had been the Lab Administrator "initially to spite [another teacher] but I really found it empowering as I thought of how much I learned and … other teachers wanted to part of the process as well" (A – 4 reflective journal). Another teacher's experience was simple but significant as she "experimented with some software and made a neat picture-thing. … A month ago, I showed it to my class and they clapped…. It spurred me on" (C – 2 field note). A participant, A – 1, succinctly summarised the process of experimenting with technology: “I came to the realization that it’s just comfort and practice. Practice and comfort” (A – 1 questionnaire).

Each of these three teachers saw the importance of trying new roles in their teaching from a major change in school position (A – 4) to a classroom experience (C – 2) to a learning attitude (A – 1). They realised that critically self reflecting and using feedback from others were necessary components to a perspective transformation (King, 2002a) vis-à-vis content reflection (Mezirow, 1995).

Another participant’s written response also exemplifies content reflection:

> I just came to the realization that I was wasting time on [technology]… so I had to change…. I think the most prominent change in terms of my teaching has been in the area of preparation. I use word processing continually to help make my classroom an organized environment rich in literacy and numeracy charts, poems and ideas. In terms of preparing my lessons to teach each day, I think technology has enabled and inspired me to produce my own “teacher packets” of activities to use with the students (A – 2 interview).

As she considered the origin of her actions (Mezirow, 1995), she came to understand that technology use could assist her in the daily teaching in her classroom.

These eight teachers had experienced the crucial element of the perspective transformation, critical self-reflection. That is, by examining their deep-seeded feelings that accompanied their original meaning scheme or perspective in the form of content reflection (Mezirow, 1991a; 1994b), they came to a new understanding of their learning. Without thinking back to what they had done in the past, content reflection, this perspective transformation would not have been possible.

Critical Reflection: Process Reflection.

Process reflection was also evident as the participants considered the aetiology of their actions and whether there were other factors yet to be unveiled (Mezirow, 1995). Five participants offered responses related to this sub-theme (69 of 207 comments across three schools).

For example, one specific questionnaire comment stands out as an exemplar due to its thoroughness in describing process reflection:

> The major change here is that [now] I do believe teachers need to be life-long learners and cannot afford to ignore technology. Many simply claim they don't understand computers and refuse to do what they ask students to do. I had to look at my own attitudes about technology and try not to confuse them with my beliefs about how much money schools should spend on technology and my disgust with the way some adults behave to obtain personal glory. They are separate and teachers need to stop finding excuses why they shouldn't learn how to use technology to make teaching and learning better. I was definitely upset with teachers using computer time as a "rest period" where students did what they wanted on the computer (play games) while the teacher marked, prepared lessons or just sat back and took it easy. This was unacceptable to me and I did not want to become this type of teacher (A – 1 questionnaire).

It is quite clear that A – 1 is critically self reflective as she considered her original actions and related factors ("I had to look at my own attitudes about technology and try not to confuse them with my beliefs about how much money schools should spend on technology"). Additionally, she had accumulated or concatenated transformations within set meaning schemes (Mezirow, 1985) ("[now] I do believe teachers need to be life-long learners and cannot afford to ignore technology”). She also eschewed any “bandwagon” mentality or peer pressure to arrive at her own belief system (Mezirow, 1994b) (“This was unacceptable to me and I did not want to become this type of teacher”).

This teacher, A – 4, recorded the following entry in her reflective journal five months after the study began:

> Before I taught the students to make slide shows on “KidPix,” I made one on my own [as you suggested to me in an email]. Sometimes I try [technology] things on my own prior to teaching my children and sometimes we explore things together. The Internet plays a big role in giving me the [necessary] information to come up with ideas for [technology] (A – 4 reflective journal).

In particular, this participant supports LaCava’s (2002) study as the teacher in my study was critically reflecting on learning activities (“I try [technology] things”) and Internet exposure (“The Internet plays a big role”) as a significant part of the new role experimentation.

Another teacher, C – 1, discussed her learning and how she had observed a major change in her view of the Internet:

> Since I started teaching, I have always kept up with what is coming along, by taking courses, workshops, reading, visiting other classrooms, and talking to people I respect. Suddenly, a few months ago, I saw the benefit of the Internet, in these few months with you, after being so sceptical for so many years. I had an epiphany! Now, Google plays a big part, too (C – 1 interview).

As can be seen from the interview response, my research supports LaCava’s (2002) study as this teacher reflected about influential people (“talking to people I respect”), significant life changes (“I had an epiphany!”), learning activities (“taking courses, workshops, reading, visiting other classrooms"), and Internet exposure ("I saw the benefit of the Internet"), all of which were highlighted in LaCava's (2002) study.

Cranton and Roy (2003) characterised this intensity as individuation or, "the *process* by which we become aware of who we are as different from others" (p. 91, original emphasis), as compared to one's uniqueness (individuality) and one's ability to concentrate on oneself (individualism). This critical self-reflection is a crucial element of transformative learning (Mezirow, 1991b).

As well, these two teachers are reflecting the beginning stage of King's (2002a, 2002e) "Affirming and Connecting" phase of transformative learning (see Table 6, Chapter 1) as they became more assured in their new meaning perspectives and make necessary connections between and among meaning schemes (Mezirow, 1985).

For another respondent, the realisation of critical process reflection was epiphanous in nature:

> As I consider what I used to do and what I do now, I would say that change just happened. I didn't really make a conscious effort. I just spent a [few] times with [two] of the children [teaching] them KidPix. I taught them how to do it and [while] I was doing my Guided Reading group, some other children said, "Hey, this is neat. Can I [learn how to use KidPix], too?" And, of course, I responded with "Yes" if the child was ready (B – 2 interview).

She came to the conclusion that she had changed from a sage on the stage to a guide on the side (Kitchenham, 2003); from constructivist to facilitator (Lawler & King, 2003).

Another teacher, B – 1, outlined how she had come to question her role as a Learning Assistance teacher:

> If the school would give replacement time for me as an [Learning Assistance] teacher, I could go and help people with the computer problems but they don't even do that. That lack of respect made me realise why I am so disgruntled with the district (B – 1 interview).

To this teacher, the district did not see her position as valuable enough to replace her during absences and, yet, her role expectation had always been to be helpful to other teachers. Exemplifying process reflection, she identified the lack of respect for her as the origin of her being upset with the school district.

Another quote demonstrates the intensity of realising the origins of one's actions, or process reflection (see Figure 8):

> I have started saying, "Who cares?", and I just don't do some of the work that I really should. Maybe that is why this year is not going well and why I am so grumpy with the kids. This is not me and I resent the change (C – 1).

She considered the origins of what she used to do and now what she was prepared to do in the future in the form of an intense reaction.

The three previous examples also demonstrate that my research supports Mezirow's (1985a, 1995) learning process within a learning function. In their process reflection, the teachers are operating self-reflectively by acquiring new meaning schemes that are compatible with their existing schemes within their respective meaning perspectives. The first teacher, B – 2, examined her belief system of what a teacher should be and revised the notion to include her new role. The second, B – 1, came to view herself as a technology specialist as well as a Learning Assistance teacher. The last, C – 1, reflected on her previous work ethic, considered the factors related to that past, and revised her present work ethic. All three teachers needed to consider the origins of their actions and the related factors in order to adopt their new meaning schemes (Mezirow, 1995).

All five teachers, A – 1, A – 4, B – 1, B – 2, and C – 1, had experienced the sub-theme of process reflection (Mezirow, 1991a; 1994b). That is, they critically reflected on the origins of their actions and considered whether there were other factors yet to be revealed.

Critical Reflection: Premise Reflection.

Premise reflection was evident in three participants' responses. Rather than thinking back to past experiences (content reflection) or considering the origin of their actions and whether there were still other factors to be unveiled (process reflection), the participants examined the broader implications of their perspective transformations (Mezirow, 1995). Three participants, A – 4, C – 1, and A – 1, offered responses related to this sub-theme (86 of 207 comments from School A & C). No responses were offered by the School B participants.

Two teachers reported their ideas about social roles and how they were beginning to query what a teacher should do compared with what a teacher is expected to do (LAS – PD TECH Statement 2; see Table 15, Chapter 3).

The first participant, A – 4, described an experience of discussing personal hygiene with a young mother who had three children under the age of six:

> Twenty years ago, I was expected to teach the 3 Rs and nurture the students …. Now I am expected to be counsellor, social worker, teacher, mother, father, multiple specialist [and] curriculum designer … all in six hours a day! … The other day, I just said that I would concentrate on meeting the district goals and get some tech and that was it (A – 4 interview).

This experience prompted an obvious reflection on her teaching career and how it had changed over the span of twenty years.

A second teacher in another school, C – 1, summed up her feelings by saying, "I just don't care anymore. I am an 8 [o'clock] to 5 [o'clock] teacher now and get done what I get done…. I punch a clock …. That feeling of failure is there everyday now" (C – 1 interview). For this teacher, the broader implications of her perspective transformation were to consider herself as a failure.

These two teachers were questioning their roles as teachers in a broader context and, in the process, were feeling the pressure to change their meaning schemes and perspectives. At this stage, they appear to be dialogic and critically self reflective in their approaches as they closely examine the specific context for learning to take place (dialogic), and the reasoning behind learning the information (self-reflective). Specifically, A – 4 has begun to question whether schools are places where teachers teach the basic facts to the students or whether they have become places where teachers are expected to fulfill the many roles of "counsellor, social worker, teacher, mother, father, multiple specialist … curriculum designer." C – 1 sees her role as a factory worker who has to "punch a clock" every day rather than a teacher who is content in her role ("That feeling of failure is there everyday now").

In addition, their comments support Mezirow's (2003) argument that communicative learning, involving analogic-deductive logic is a crucial part of transformative learning. That is, A – 4 reasoned from the concrete example of counselling the 22-year-old mother, as an example of one experience, to the abstract conceptualisation that her role had increased to include many responsibilities and roles. Similarly, C – 1 had reasoned from many concrete examples of feeling frustrated and under-appreciated by the administrator to the abstract conceptualisation of her role as a factory worker who had a specific number hours to work ("I am an 8 [o'clock] to 5 [o'clock] teacher now") and little responsibility after leaving her place of employment.

The third interviewee who exemplified premise reflection described the process she goes through when making decisions about technology integration and teaching in her primary classroom:

> I love technology. So I will always be looking to see what I can do and every year I do add something new. And I adapt what I have to make it work better. Like I've given up long projects for [this] grade because we're in the lab once a week for 30 minutes. The technology is not set up so that we can use it on an on-going basis, so I have to make sure that the projects are quite short, otherwise they only last a month. So I have to be very careful, so I do change and adapt. And when new technology comes out, I look at it and I try to think of new ways to use it. But it's not always in my direct teaching (A – 1 interview).

In other words, she reflected critically on the larger view of what is operating in her value system.

As well, this teacher is, in essence, describing what King (2002e) characterised as "one of [the] fundamental transformations of perspectives, ways of understanding, and empowerment that goes beyond technology (the innovation) itself and is best explained through transformational learning theory" (p. 199). She is critically self reflective as she considers carefully the requisite information for success ("So I have to be very careful, so I do change and adapt."), the time allotted ("once a week for 30 minutes"), the resources available ("The technology is not set up so that we can use it on an on-going basis"), and the end result ("I try to think of new ways to use it").

When these three participants critically reflected on the broader implications of their perspective transformations, they became aware of their technology development. This awareness led to a more conscious understanding of their social roles (C – 1; A – 4) or to a critical examination of technology use (A – 1). The fact that none of the School B participants offered any premise reflection responses is evidence of their school culture contract of performance learning sects as the teachers were encouraged by the present administrator to address their school goals in literacy, numeracy, and social responsibility to the exclusion of the broader implications of technology infusion.

Critical Reflection: Objective Reframing of Narrative Assumptions.

Critical self-reflection of and on assumptions was evident in the participant comments (354 of 561 comments; see Figures 2 and 3, Chapter 1, and Figure 8, this chapter).

Critical reflection of assumptions was evident in the objective reframing of narrative assumptions. In this process of critical reflection, the participants critically examined something that was being communicated to them (Mezirow, 1998). Eight teachers offered comments related to this sub-theme (58 of 354 comments across three schools). Comments by three participants serve as evidence of objective reframing of narrative assumptions as the teachers offered specific evidence of their respective critical examinations.

After leaving an Ontario classroom in which a specialist taught all technology, one teacher, A – 1, accepted a position in a British Columbia where she was expected to teach her own technology skills whereas, in Ontario, technology teaching was the responsibility of an educational technology specialist teacher. The students' needs became a major impetus for change and continued to be a driving force for her during the subsequent 20 years of teaching: "Because kids would ask questions and I didn't have a clue. I think that once you make that decision, because technology keeps changing, if you are provided with tools, then why not use them?" (A – 1 reflective journal). This teacher was demonstrating narrative critical reflection of assumptions which required her examining something that was communicated to her ("kids would ask questions") and resulted in her adopting educational technology.

This same teacher, A – 1, exemplified King's (2003) finding that teachers experienced six changes in their teaching: (1) cultivation of critical thinking skills (e.g., "it's not enough to accept blindly, we have to scrutinize every resource"), (2) an increase in class discussions (e.g., "we have many chats in class about the effectiveness of technology"), (3) an increase in student-centeredness (e.g., "I tend to get the students doing more and more so that I can stand back and observe"), (4) engaging students in constructivist learning (e.g., "the students have input into their projects and how one [technology project] complements another"), (5) becoming more organized (e.g., technology has helped me to streamline my teaching and personal life"), and (6) using computer and Internet resources in the classes (e.g., "if I think that the websites or programs are useful, I will use them").

Another interviewee echoed the importance of the positive reactions from her Grade Five students: "The kids love it. They enjoy it because they're going somewhere different. They love computers and they're very comfortable with that whole scenario [of completing technology projects]. I see the benefit through them where I did not see it before. I will continue such technology projects" (C – 2 interview). Similar to A – 1, this teacher was using information communicated by others, her Grade Five students, to objectively reframe her assumptions about educational technology.

One last comment from a participant, B – 2, exemplified the need for learners in general—and for her, in particular—to receive positive feedback from colleagues:

> I really need that sort of reinforcement from other teachers that I doing an okay job. [For instance, the librarian] has been watching because she is in the library [to which the computer lab is attached]. She's been watching our iMovie [lessons]. I've done a whole unit on iMovie with the kids so she asked if I could teach it [to other classes] (B – 2 interview).

This teacher demonstrated how she was using objective reframing of narrative assumptions as she used feedback from colleagues and discussions with the librarian to encourage her to continue with her educational technology use. This desire to use others' opinions to accomplish personal professional development goals was not typical of School B's contrived collegiality school culture (Hargreaves, 2003; see Table 20). However, it was representative of the three School B participants' sub-culture and their commitment to support each other, despite their contradictory school culture.

These three participants critically examined something that was being communicated to them (Mezirow, 1998). This critical reflection of assumptions, in the form of objective reframing of narrative assumptions, was an important part of their transformative journey and technology development. The process of critically reflecting on information being communicated to them allowed them the opportunity to see the benefits of technology infusion.

Critical Reflection: Objective Reframing of Action Assumptions.

When attention is shifted from assumptions arising from statements made by others (narrative assumptions) to assumptions evident in the process of an individual or group solving problems, objective reframing of action assumptions is evidenced. All 10 participants offered responses (71 of 354 comments) that exemplified objective reframing in the form of critical reflections of action assumptions. In other words, they considered their own assumptions within the context of a problem-solving situation (Mezirow, 1998).

One teacher expressed her assumptions on educational technology in a forthright fashion:

> I thought, in the beginning, it would make life easier. … Technology totally cuts down on so much of your work, in the long run, but you have to put in the time to master the programs. [When] you actually do the work, technology saves so much time and energy (B – 1 reflective journal).

This teacher recognised the problem of devoting the time to learning the software programs ("you have to put in the time to master the programs") within her own assumptions that technology would help her in her daily life ("it would make life easier").

Seven teachers, including B – 1, expressed fundamental changes in their thinking because of their acquiring educational technology skills: "By learning about technology I no longer feel so strongly about the money spent on computers [and] I see its benefits in less prep time" (A – 4 questionnaire); "Even [the student teachers'] lesson plans done on computer looked more professional. I tried doing more prep on the computer and [now] see how [technology] saves me time" (C – 1 interview); "I focussed on learning two programs well (CoWriter and KidPix) [and] now see how much time I save. Time I could use to work with the students" (B – 2 interview);

> Rather than using a published, purchasable unit of study, I research ideas on the Internet, create my own activity pages using [Microsoft] Word and link suitable sites to my web page. [Technology] saves scads of time (A – 2 reflective journal).

> This is brand new. As though you've never done it before. It is learning it for the first time. You don't recall how it was done. You can't. You just waste more time doing trial and error until you either figure it out or you give up. I won't give up easily. I figure I'm in charge here, not the computer, and I'm not going to let it win! (B – 1 interview).

> I found that I spent so much time at the copier before [so] now I am experimenting with different ways to save time using [technology]. For example I might use the Internet for almost all of my research projects now (B – 3 interview).

> I love learning new things and will always question my role and try new roles. I constantly change my teaching assignment to keep myself fresh and excited about what I do. I also love electronic gadgets [and] I've been able to justify the time and cost required to use many of them in teaching (A – 1 interview).

In short, each teacher reported a different way of acting; however, the common problem-solving situation for all seven participants was the notion of learning technology well in order to lessen the amount of time spent on preparation for teaching (“I see its benefits in less prep time” [A – 4]; “I tried doing more prep on the computer and [now] see how [technology] saves me time” [C -1]; “I focussed on learning two programs well (CoWriter and KidPix) [and] now see how much time I save” [B – 2]; “I research ideas on the Internet, create my own activity pages on Word and link suitable sites to my web page” [A – 2]; “technology saves so much time and energy” [B -1]; “now I am experimenting with different ways to save time using [technology]” [B – 3]; and “I’ve been able to justify the time and cost required to use many of them in teaching” [A – 1]).

Two versions of an overheard staff room conversation epitomise the doubting attitude about the utility of computers and critical reflection of action assumptions:

> Not too long ago in our staff room, we had a person say that she did not feel that there should be computers in the elementary schools. That it wasn’t necessary. Now, this person, [who was] probably where I was [a few years ago in my technology development], has not learned anything new about computers nor moved ahead or seen the value of how they can be integrated. So I understand where she was coming from because if you don’t put in the time and effort to learn, they seem like a waste (A – 4 interview).

> Yesterday in the staff room I sat across from two colleagues. One of whom said, “I would probably get stoned for this if I said it louder. But I don’t think we should have computers in [the] primary [kindergarten to grade 3] in elementary schools.” And I happened to be sitting by another person who did everything [she] could to control [her] blood pressure at that point. The [colleague controlling herself] was talking to someone on her other side and continued that conversation [without reacting]…. I certainly know the

> argument from both sides as I could have been the "doubting Thomas" only a while ago (A – 3 interview).

These two teachers are representing action critical reflection on assumptions as they debate the benefits of educational technology. The first teacher, A – 4, empathised with the colleague as she had previously defined the problem as weighing the benefits of learning educational technology skills ("So I understand where she was coming from because if you don't put in the time and effort to learn, they seem like a waste") and examining her own assumptions about the limited time available to devote to further learning of new skills. The second teacher, A – 3, also understood the assumptions about technology use ("I certainly know the argument from both sides as I could have been the 'doubting Thomas' only a while ago") but had obviously persevered and examined her assumptions in a task-oriented setting to solve the problems encountered within my research study.

These two excerpts offer support for King's (2002a, 2002e) "Testing and Exploring" phase of the transformative journey (see Table 6, Chapter 1) and Mezirow's (1978a, 1978b) original research on the phases of transformative learning (see Table 1, Chapter 1). Part of perspective transformation is to acknowledge that others experience discontent with their meaning schemes and perspectives and recognising that the process of transformation is shared (King's Phase 4: Recognition that one's discontent and the process of transformation are shared and that others have negotiated a similar change). These two teachers expressed that discontent and acknowledged a level of sharing the transformation ("So I understand where she was coming from because if you don't put in the time and effort to learn, they seem like a waste"; "I certainly know the argument from both sides as I could have been the 'doubting Thomas' only a while ago"). In addition, understanding that one is not alone in questioning one's beliefs is a critical part of fostering critical reflection in adulthood and in transformative learning theory (Mezirow and Associates, 1990).

Three further examples demonstrate objective reframing through action critical reflection of assumptions. The first participant recorded in her reflective journal:

> The other thing I like about Gradekeeper is that I can show the kids their marks throughout the term so that they know where they are. At first, I didn't like it but I do see the benefits now (C – 2 reflective journal).

To this teacher, learning a new software program was beneficial because of the empowerment given to the children in her Grade Five class.

Her School C colleague also commented on using computers with his Summer School students:

> I don't really do much technology with my French students during the regular year. With the [English-as-a-second-language] students in the summer, I introduce language concepts using a software game [Grammar Games] on a daily basis after searching for hours for a worthwhile [software] program. These students expect the computer to be used everyday" (C – 3 reflective journal).

For this teacher, the utility of a software program that introduces the linguistic concepts he would present through "worksheet after worksheet" (C – 3 interview) and the fact that his students expected the computer used convinced him to use it on a daily basis.

A teacher in another school also realised the benefits of technology for her students: "Trying to produce PowerPoint presentations in the classroom was a nightmare, yet the end result was exciting and well received by parents and students.

Both expect it of me” (A – 1). This teacher persevered because she felt the passion from both the Grade Three students and their parents.

All three of these teachers critically considered their own assumptions in a task-oriented problem-solving situation to define the problem itself: the need to be convinced that Gradekeeper, Grammar Games, and PowerPoint, respectively, were worth the time and effort. During the course of my study, they came to the conclusion that the software programs were worth it.

This sort of student benefit echoes the NetDay (2004) results that students expect to use technology in their schools. Conducted in 2003, the purpose of the survey of 210, 000 American, kindergarten to Grade 12 students, was “to capture the ‘pulse’ of student views on technology and education and to provide an opportunity for every student to share their ideas” (p. 5). Germane to my study, 82% of students in grades K to 3, 95% in grades 3 to 6, and 97% in grades 7 to 12 indicated that they expected to use technology in school. The comments expressed by these three teachers, C – 2, C – 3, and A – 1, support the NetDay (2004) data as their Grade Five, ESL, and Grade Three students, respectively, indicated that they expected technology to be incorporated into their classrooms.

These 10 participants considered their own assumptions within the context of a problem-solving situation (Mezirow, 1998) over the duration of my study. All came to the conclusion that their respective educational technology ventures were well worth the time and effort invested over the seven months of my research.

Critical Reflection: Subjective reframing of Critical Self-reflection on Assumptions.

Mezirow (1998) argued that “learning to think for oneself involves becoming critically reflective of assumptions and participating in discourse to validate beliefs, intentions, values and feelings" (p. 197). Critical reflection on assumptions was evident in the subjective reframing of four types of assumptions, narrative, systemic, therapeutic, and epistemic (Mezirow, 1998), as evidenced in the responses from the 10 participants (225 of 354 comments).

Narrative

The first type of subjective reframing of critical self-reflection on assumptions occurred as the participants applied *narrative* critical reflection on assumptions to themselves (Mezirow, 1998; see Figure 8). That is, six participants carried over insight gained from a narrative into their own experiences (Mezirow, 1989). One teacher responded,

> I found that I needed to be in control of my own learning…. Attending distance education workshops wouldn't work for me so I chatted with other teachers on staff and a few in other places … so that we could work together to create WebQuests (C – 1 interview).

Along a similar vein, three other teachers stressed the importance of having input into what they wanted to learn and of collegiality: "having the opportunity to discuss my concerns with other like-minded teachers helped me" (A – 4); "it finally dawned on me that my actions would change if I had help from other colleagues" (B -1); and "the action plan made me aware of how important it was to work with someone I trust" (C – 2). In other words, the idea of applying previous conversations to their present lived experiences through critical self-reflection was an important element of these three teachers' perspective transformations.

Six additional quotes strengthen the argument that conversation was critical to the teachers' perspective transformations:

[School A] is not this type of school. I honestly believe most staff members are life-long learners and, best of all, most do not “block” new ideas, programs, etc. They are always questioning what they do and looking for better ways to be better teachers. Technology is a big part of that questioning (A – 1 reflective journal).

Through conversation I found that a colleague was in a similar place and she too wanted to create [a webpage] that was useable and real. With support of one another, [the researcher’s] leadership, and the money from the NIS project (which gave us release time) we were able to create our own pages. Other colleagues were impressed and supportive, but not yet ready to undertake the same learning challenge. I have invited other teachers to use what I have created with their own classes (A – 2 interview).

At first, I felt that I was letting down my colleagues but after a few months of working on my action plan, I started to work with my colleagues more often. Mostly A – 2 as we do so much of our teaching together. Anyway, she gave me some templates, we talked tons, and then I was able to make a simple webpage (A – 3 interview).

Mostly through [conversations with] you and my student teachers, I have decided that I am more comfortable with my role after trying out various approaches. Basically, I have changed in my belief about the usefulness of technology for six year olds. I now believe that computers when integrated into what I am teaching can be a valuable tool (A – 4 interview).

> I think the district expectations of what we should be doing with kids with special needs is warped. They have the ideas and push the product (now it's Kurtzweiler? - the OCR program) but offer no support or dollars to bring your older computers up to today's standards (i.e., more memory, bigger drives to run these huge programs). I have had discussions with lots of teachers, here and in other schools, [and we talk about] whether the tech is really worth the effort when there is no more money and little support … I think that we definitely find our answers in our classrooms, though (B – 1 interview).

> I see the benefits of talking through educational technology. I have gained so much confidence in my abilities because I could chat with you, [B – 1] and [B – 3] whenever I needed some help. As you probably notice, I rely less on everyone now (B – 2 reflective journal).

These six examples further reinforced the importance of discussing educational technology issues and then applying their newly-acquired assumptions in the classroom.

All seven of these teachers in this section, A – 1, A – 2, A – 3, A – 4, B -1, B – 2, C – 1, and C – 2, exemplified critical self-reflection on assumptions as they applied *narrative* critical reflection on assumptions to themselves (Mezirow, 1998) and saw the benefits of collegiality and collaboration in acquiring educational technology skills. In other words, they used insight from a narrative, such as a discussion with a colleague, and expressed the need to participate in critical discourse with colleagues to make informed decisions about the benefits of educational technology within the lived experiences of their respective classrooms (Mezirow, 1998).

Systemic

The second type of subjective reframing, critical self-reflection on *systemic* assumptions, was evidenced in the participant comments. One teacher questioned his role as someone who was expected to maintain contact with parents using three media (writing, telephone, and email) describing the concept of "paper pusher" rather than teacher: "So instead of having one way of communicating with parents, you have three and you're expected to check all three everyday. I know that other teachers complain about this craziness" (C – 3 interview). This teacher discussed *systemic* critical self-reflection on assumptions (see Figure 8). He self-reflected on the taken-for-granted cultural influences within his organization, the school, and questioned the utility of using three media to maintain contact with the parents (Mezirow, 1998).

Therapeutic

The third type of subjective reframing, critical self-reflection on *therapeutic* assumptions, was typified in the respondents' comments. One teacher questioned her ideal of what a teacher should be, a life-long learner, as she considered the amount of time she was expected to investigate the integration of curricular changes: "[The Head of School is] expecting us to learn, learn, learn, learn, learn, learn, learn so much that I can't concentrate on my teaching" (C – 1 reflective journal). She also felt incredibly passionate about her lack of technology development as she wrote:

> I feel guilty about not using technology. I have considered leaving teaching because I don't use technology. It seems to me that I appear to others, those who are technologically "hip", as in the dark ages. It is interesting however, that even though there are designated technology specialist teachers in our school, the class I work with most cannot send attachments, email properly or use PowerPoint yet (C – 1 interview).

She was discussing her *therapeutic* critical self-reflection on assumptions as she examined her problematic feelings and their related consequences (Mezirow, 1998; see Figure 8). This teacher's response typifies what Mezirow (1985) characterised as an "epochal [and] painful" (p. 24) transformation of her sets of meaning schemes as her revised concepts, beliefs, judgments, and feelings have shaped this specific interpretation of the traditional expectation of teachers using technology (Mezirow, 1994b). This expectation was in conflict with her understanding of the technology specialist's role which included teaching email skills and PowerPoint applications.

Epistemic

The fourth, and last, type of subjective reframing, critical self-reflection on *epistemic* assumptions, was reflected in the teachers' comments. Two teachers offered critically self-reflective comments in relation to educational technology. By observing a student teacher present a PowerPoint-based lesson, one teacher began to question her role in relation to parents in the classroom:

> And the parents I've got to educate better, too, because I had a couple of parents who did it for the kids which drives me crazy. So, some of the kids didn't do very much because they just sat there [and] the parents did it for them. [Then the students] just sat for a little bit more until the next step. It makes me wonder if parent-helpers are more of a hindrance (A – 1 interview).

Another teacher, B – 3, commented:

> I am wondering if I am hardwired to be a helper because I can't stop assisting colleagues even when I know that they won't try to learn the skills. I even learn the [software] program so they won't have to when I am even busier than they are. … I am getting really angry with those people! (B – 3 interview).

These teachers represented *epistemic* critical self-reflection on assumptions as they investigated not only the assumptions but also the causes, the nature, and the consequences of their respective frames of reference to surmise why they were predisposed to act in a certain manner (Mezirow, 1998; see Figure 8). By observing the student teacher, A - 1 was able to see how her role must change in relation to using parent-helpers in the computer lab. Similarly, B – 3 realised that she needed to change so that she helped her colleagues less as she was obviously becoming resentful at the amount of time she spent assisting them.

Summary: Critical Reflection

The participant comments from the 10 teachers in this section reinforced the theme of a critical reflection of assumptions and critical self-reflection on assumptions as they described situations in which they were faced with a problem and had to rely on a community of learners to arrive at a reasonable solution. In other words, they posited many answers to a series of educational technology questions but agreed on set solutions by discussing the possibilities with their peers, when feasible, and adjusting their respective habits of mind (Mezirow, 1985, 1991, 2000). Given the fact that teachers are often reticent about using educational technology (Jones, 2004; Larner & Timberlake, 1995; Russell & Bradley, 1997) and the fact that each teacher in this study became more confident in their technology use as they engaged in critical discourse, critical reflection, and critical self-reflection, there appears to be a sound argument for teachers using these three transformative learning processes when learning educational technology.

Individual Themes of Perspective Transformation Summary

The data described in the preceding section demonstrated that the teachers experienced a perspective transformation due to their development in technology (see Table 22 & Figure 8). There were numerous instances of change in perspective, altered meaning schemes and meaning perspectives, revised habits of mind, evidence of critical discourse and critical reflection of assumptions and critical self-reflection on assumptions (King, 2002a, 2002e; Mezirow, 1981, 1985, 1991a, 1994b, 2003).

There is evidence of some connection among the three school cultures, the seven systemic external factors, and the five perspective transformation themes (see Figure 8). For instance, the School A school culture regime of collaborative culture supported a learning environment in which perspective transformation themes were evident. As well, the connections between collaboration, administrator support, time, and targeted funding as major promoting factors were evidenced in myriad comments from the participants as they discussed individual perspective transformation themes. However, the impeding factors of gauleiter, infrastructure, and administrator support were reflected less often in the participant responses related to the five individual perspective transformation themes.

Transformative Learning as a Research Framework

This section addresses Research Question Two: *Is transformative learning a viable research framework to describe the teachers' development in technology use, integration, or teaching?* Cranton's (1994) four stages of learner empowerment were used as themes to characterise the participants' comments on the strength of transformative learning theory as they were robust and representative of andragogy and transformative learning, both of which were an important part of the research framework. Therefore, the structure of this third chapter section is divided into four sub-sections that represent each of Cranton's (1994) four stages of learner empowerment: (1) initial learner empowerment, (2) critical self-reflection, (3) transformative learning, and (4) autonomy.

Initial Learner Empowerment

Two salient responses reinforced the sense of empowerment experienced by two teachers from different school cultures as they acquired educational technology skills within a transformative learning framework. In his reflective journal, the first learner described his feeling of empowerment as:

> a realization that I was in control and could learn because I wanted to learn and not because someone told me to. I had an opportunity to consider [in the action plan] what I could realistically learn as an adult and how quickly (C – 3 reflective journal).

For him, gaining control over his own learning through the professional development action plan led to a clear feeling of empowerment; however, C – 3 did not complete his professional development goal, despite his early verve to complete. The second learner reported in her reflective journal that,

> this project has been a wake up call for me. I was resentful about technology and it's made me realize that I am a teacher of kids and not of curriculum! Without this opportunity to consider how I learn [as an adult], I might have missed it…. I feel like I have the power now (A – 4 reflective journal).

She was quite clear in describing her epiphanous learning as she felt empowered.

Clearly, these two teachers saw the potential for a framework that required them to reflect on their own learning processes (Cranton, 1994; Mezirow and Associates, 1990; Taylor, 2000) ("an opportunity to consider" [C – 3]; "to consider how I learn" [A – 4]), to see the benefit of how adults learn (LaCava, 2002; Mezirow,

1985) ("what I could realistically learn as an adult" [C – 3]; "how I learn [as an adult] [A – 4]), and to recognise that this framework led to empowerment in the early stages of the learning process (King, 2002a; Mezirow, 1995) ("realization that I was in control" [C – 3]; "I feel like I have the power now" [A – 4]). The sense of empowerment led to more confidence and competence in educational technology. This initial feeling of empowerment led to A – 4 completing her professional development goal; however, interestingly, C – 3 appeared to lose that feeling later in the study as more and more teaching responsibilities were assigned to him.

Critical Self-reflection

Critical reflection and critical self-reflection are important in transformative learning and were paramount in the research framework used in this study. Two comments reinforced the idea of critical reflection in educational technology.

One teacher added this comment to her questionnaire as she outlined her process of learning to date: "I really thought through what I was doing when I learned technology. … This [transformative learning] model you've presented helped me to become more aware of that process" (B – 2 questionnaire). She commented on the critical self-reflection on her learning process as actualised through the research model. The research framework encouraged critical self-reflection on the participants' respective learning processes so that all 10 reported feeling more aware of their ways of learning educational technology.

A teacher in another school chose to add this informative sentence to her questionnaire:

> I went over the statements on the first page and they helped me realize how I had been learning before and why I didn't seem to get it …I went away and

> thought about those statements and my learning. It was all about [who had the] power and control (A – 1 questionnaire).

In other words, the Learning Activities Survey – Professional Development in Technology teacher questionnaire statements assisted this teacher in considering her learning process. It appeared to be the critical self-reflection on that learning that caused her to realise that the transformative learning model brought forth power and control for her.

These two examples also show the importance of critical self-reflection of assumptions in perspective transformations (Mezirow, 1998); more specifically, the process of subjective reframing. B – 2 was describing a *narrative* critical self-reflection on assumptions as she applied those assumptions to herself ("I really thought through what I was doing when I learned technology"). A – 1 was *epistemic* in nature as she investigated not only the assumptions ("realize how I had been learning before") but also the causes, the nature, and the consequences of her frames of reference to surmise why she was predisposed to learn in a certain manner ("I went away and thought about those statements and my learning. It was all about [who had the] power and control").

Further, Mezirow (1998) argued that "learning to think for oneself involves becoming critically reflective of assumptions and participating in discourse to validate beliefs, intentions, values and feelings" (p. 197). The fact that these two teachers commented on their assumptions caused them to realise that change had occurred vis-à-vis the transformative learning research framework. In other words, engaging in critical discourse allowed their preconceived assumptions to surface.

Transformative Learning

Six participants commented on the elements of transformative learning in relation to the research. One teacher, A – 3, expressed her thoughts as “a whole bunch of ideas floating together and then coming together to form a new point of view … because the project asked me to consider how I learn” (A – 3 reflective journal). Another, A – 4, argued that “this model of learning technology has really forced me to consider why I was so influenced by others and how resentful I became of their ideas of technology” (A – 4 interview). The transformative learning model appeared to work well for these two teachers as they recognised the potential in considering their own learning which was inherent in the framework.

In another school, one teacher, B – 1, summed up this study’s research framework as “the best model I’ve seen for helping us understand why we learn the way we do” (B – 1 interview) and another, B – 3, simply stated, “I have totally revamped what I believe now is the role of a teacher in regards to technology… thanks to this model” (B – 3 interview). Quite clearly, they attributed a portion of their educational technology development to the research framework and the transformative learning model.

In the third school, two teachers, C – 1 and C – 2, pointed out the importance of “expanding on what I know … about how I learn” (C – 1 reflective journal) and “getting an opportunity to discuss how I learn … and an opportunity to tell you that I would like to do more” (C – 2 interview). These two teachers acknowledged the strength of transformative learning, as embedded in the research framework, as it allowed them opportunity to increase their knowledge of educational technology and to express how and what they learned.

These six teachers were commenting on the importance of transformative learning as a research framework. Two of the teachers, A – 3 and C – 1, were describing learning by elaborating on their existing frames of reference (Mezirow, 1991a) ("coming together to form a new point of view" [A – 3]; "expanding on what I know … about how I learn" [C – 1]) while two other teachers, C – 2 and B – 2, were discussing the learning of new frames of reference (Mezirow, 1991b) ("getting an opportunity to discuss how I learn" [C – 2]; "helping us understand why we learn the way we do" [B – 2]). The remaining two teachers, B – 3 and A – 4, articulated the ideas of transforming habits of mind (Mezirow, 1994b) ("revamped what I believe now is the role of a teacher in regards to technology" [B – 3]) and transforming a point of view (Mezirow, 2000) ("consider why I was so influenced by others and how resentful I became of their ideas of technology" [A – 4]), respectively. Based on these six participants' responses, transformative learning proved to be a viable research framework.

Autonomy

Many instances of the participants commenting on the need for learning on their own and being in control of the learning process surfaced during this research study (56 comments across three schools). Three stand out due to their succinct and forthright expression of learning:

> You mean the adult would make a decision that this is what I want to learn and no one would tell them what to learn? I think that it would great. It is similar to what we've been doing (B – 2).

> For change to take place and for people to learn more, you need a model like this one. If they don't have the power or the control over what they're learning and how it's going to be done, [then] no success happens (A – 4).

> Being able to have time to practise is good but having the freedom to decide what we want to learn as adults and being left on our own with the offer of assistance when needed is the only way to go (A – 2).

For these three teachers, this research framework of transformative learning brought them power and control over their own learning processes.

As well, when these teachers considered the research framework I used in this study as they answered the last question of the interview ("The theoretical framework I am using in this study is 'Transformative Learning' which is based on the three key principles of adult learning: (1) autonomy; (2) empowerment; and (3) collaboration. In your opinion, is this framework viable for teachers' development in technology?"), they provided comments that were reminiscent of Mezirow's (1995) three types of reflection and their emphasis on a learner making informed decisions. The content reflection expressed by B – 2 shows her thinking back to what was done previously and comparing that experience to my study which stressed empowerment and freedom to make decisions ("the adult would make a decision that this is what I want to learn"). Process reflection, as expressed by A – 4, caused her to consider the aetiology of one's actions and whether there were other factors yet to be unveiled within one's control ("If they don't have the power or the control over what they're learning and how it's going to be done, [then] no success happens"). As A – 2 asked herself to see the larger view of what was operating within her value system ("being left on our own"), she was demonstrating premise reflection.

Transformative Learning as a Research Framework Summary

To confirm that the conception of transformative learning used in this study provides a viable framework for educational technology research, it was necessary to show that the elements of disorienting dilemma, altered meaning schemes and perspectives, revised frame of reference, types of learning and learning processes, and critical reflection (see Figure 8 & Table 22) were present in the research data. Given the richness of the analysed responses provided in the reflective journals, teacher questionnaire, semi-structured interview, and my field notes, transformative learning appears to be a viable framework to describe the teachers' development in technology use, integration, and teaching. Additionally, all 10 participants indicated that transformative learning theory was a defensible research framework in direct answer to the final interview question. Their responses supported Cranton's (1994) four stages of learner empowerment: initial learner empowerment, critical self-reflection, transformative learning, and autonomy. The participants elaborated on the notion of empowerment espoused by the theory so that, from the beginning of the study, they felt in control of their learning processes (i.e., initial learner empowerment). Their comments demonstrated that thinking about their own learning processes was a major strength of the theory (i.e., critical self-reflection). The teachers commented on how the transformative learning research framework encouraged working with other colleagues during which time they might have altered their habits of mind or adopted new points of view (Mezirow, 2000) (i.e., transformative learning). Lastly, the participants outlined the autonomic aspects of the research framework so that they knew what they were learning and how quickly they learned what they wanted (i.e., autonomy). In short, Research Question Two was answered affirmatively based on these 10 participants' analysed comments and direct reports that transformative learning proved a viable research framework to describe the teachers' development in technology use, integration, and teaching.

Transformative Learner of Technology

As I analysed the data, I witnessed the emergence of a possible transformative, or transformed, learner of technology. It became apparent that those teachers who exhibited a high degree of perspective transformation exemplified specific characteristics as did those teachers who demonstrated a lower degree of perspective transformation.

The two sources of data that I examined to extract the tentative characteristics of a transformative learner of technology were my field notes and the demographic information provided by each participant (see Table 14, Chapter 3). This section describes the six characteristics of a transformative learner of technology based on the number of comments provided by the teachers exhibiting a high degree of perspective transformation (see Table 23), my observational and anecdotal field notes, and the demographic information on each teacher.

Table 23: *Summary of high and low degree of perspective transformation by teacher and overall totals (in raw number)*

High degree of perspective transformation						
	A – 1	A – 2	A – 4	B – 1	C- 1	Overall total
Total	264	122	132	215	135	868
Low degree of perspective transformation						
	A – 3	B – 2	B – 3	C- 2	C- 3	Overall total
Total	80	111	113	110	91	505

Table 23 represents the differences in number of statements between the teachers who exhibited a high degree of perspective transformations and the teachers who exhibited a low degree of perspective transformation.

First and foremost, a transformative learner of technology is collaborative. It was apparent that the participants in this study who epitomised many of the LAS – PD TECH statements, were teachers who saw the benefits of discussing beliefs, opinions, social mores, and pedagogy with their colleagues. Although the sample of teachers was skewed in favour of females (nine females; one male) as is the distribution of all elementary schools in British Columbia (Statistics Canada, 2003), the literature in gender differences supports the notion that collaboration is a female characteristic vis-à-vis females' superiority in verbal communication (AAUW, 1998; Alloway & Gilbert, 2002; Gurian, 2001; Kitchenham, 2002; Millard, 2002; OECD, 2000; Sadker & Sadker, 2003; Schafer, 2000). In other words, the collaborative transformative learner is most likely female. As pointed out in the recommendations (Chapter 5), this contention needs further research utilising transformative learning theory.

A learner of technology who has been transformed is a person who is not only open minded but also independent minded. All five of the teachers who experienced a high degree of perspective transformation (see Table 23) commented on aspects of transformative learning that were clearly open to discussing issues with their colleagues; however, they were also adamant that they were willing to make decisions that contradicted their colleagues. One example stands out: "I would like to believe that I am not influenced so greatly that it changes my *whole* attitude" (A – 1; my italics). In other words, these teachers were willing to listen to their colleagues' opinions but not necessarily adopt those opinions without critical thought.

This distinction between collaborating on decisions and holding on to one's belief is consistent with Mezirow's (2000) argument that one can try on colleagues' points of view but not their habits of mind and Cranton and Roy's (2003) concepts of individuation, which is the process of realising that they are different from their colleagues, and authenticity, that is, expressing their genuine selves within the learning community.

There was evidence that transformative learners of technology tended to set priorities related to the use, integration, and teaching of technology. Firstly, they tend to put their students first (e.g., "I have changed in my belief about the usefulness of technology for six year olds" [A – 4]) so that they make a decision as to whether the technology would benefit the pupils and become critical if it does not (e.g., "it has to be worthwhile for the students or I won't use it" [A – 1]). Secondly, the teacher looks at the advantages and disadvantages of the software or hardware for enhancing the curriculum (e.g., "I see the benefits of using WebQuests"[C – 1]). This critical examination means that the infused technology needs to augment what is taught in reading or science, for example, rather than replace the content area. Lastly, the transformative learners of technology decide if it is advantageous to their own roles as teachers (e.g., "I can see that [technology] helps me in so many ways in my [Learning Assistance] position" [B – 1]). This means that if there is a clear benefit for saving time in lesson preparation or improving lesson delivery, for instance, the technology would be adopted; if not, it would be abandoned.

It appears that transformative learners of technology take initiative. They see a possibility for change and seize it (e.g., "We saw the benefits from the [Network of Innovation Schools] grant so we ensured that we kept up with technology" [A – 2]). It is not enough for this type of learner to sit back and wait for change. They go out and make the necessary change, often in consultation with colleagues and administration. Interestingly, and contradictory to the school change and technology innovation literature (Bates, 2000; George & Camarata, 1996; Fullan, 1999, 2001a, 2001b; Fullan & Hargreaves, 1996; Hargreaves, 2003; Means & Olson, 1995; Means, Penuel, & Padilla, 2001; Pegrum & Anderson, 1999; Sandholz, Ringstaff, & Dwyer, 1997; Schofeld & Davidson, 2002; Stuve, 1997), none of the transformative learners appeared to initiate change for status or recognition as a change agent.

A transformative learner of technology might be a consistent achiever. Among the five of them, these teachers had 11 professional development action plan goals and successfully completed 10 of those goals. This accomplishment equates to a success rate of 91 percent. Conversely, the other five teachers also had 11 professional development goals. However, they collectively completed seven of the goals which resulted in a 64 percent success rate.

A transformative learner of technology could possess experience but not necessarily age. It is important to make the distinction between years of experience and age of the learner as this study, and others (King, 1997a; LaCava, 2002), demonstrate that a perspective transformation is not related to age. The teachers who experienced high degrees of perspective transformation in this study ranged in age from 33 (A – 2) to 54 (C – 1) and had taught from 7 years (B – 1) to 32 years (A – 1) (see Table 10 in Chapter 3). This study demonstrated that the learner needs to have experienced change, the ubiquitous "pendulum swing," in pedagogy or curriculum to understand the critical self-reflection that occurs with altered meaning schemes and perspectives.

Lastly, transformative learners of technology have a predisposition for change which is a predictor of technology use (Vannatta & Fordham, 2004). They see the merits of changing their points of view as well as their habits of mind (e.g., “As long as I see the benefit, I am willing to adopt and adapt [technology]” [A – 1]). As indicated earlier, the catalyst is usually related to the students so that the students understand the benefits of the change.

Transformative Learner of Technology Summary

The data from this study have provided tentative support for the existence of a transformative learner of technology based on the characteristics of those teachers who experienced high degrees of perspective transformations. It would appear that this type of learner is female. Transformative learners of technology are both open minded and independent minded as they are willing to listen to the opinions of others, related to educational technology, but make critical decisions as to whether they will adopt, adapt, or reject those opinions. As well, transformative learners of technology have a set of priorities for technology so that they consider, in order of greatest to least importance, the benefits to their students, to the curriculum enhancement, and to their own roles as teachers. They also tend to take initiative so that they seize opportunities to learn more technology when they arise. Transformative learners of technology possess experience but are not necessarily younger or older, in age. Finally, they are predisposed to change and therefore, are open to fast-paced and constantly-changing nature of educational technology.

Implications of this Research Study

Theoretical

Given that Research Question Two was answered in the affirmative, transformative learning proved a viable theoretical framework for studying technology development. It is also defensible to use the theory for the professional development of adult learners.

On a more specific level, the elements of transformative learning are useful descriptors of technology development. These elements provide guidance for facilitating adult learning, in general, and adult learning of educational technology, in particular. By examining the experience that causes a teacher to embrace or reject technology (disorienting dilemma), an argument for promoting a change in that teacher (perspective transformation) could be made. As well, when one thinks back on past experiences (critical self-reflection) from a sociological, psychological, or epistemological stance (meaning scheme), the learners can understand how to make changes by altering their past experiences to match their new set of assumptions (meaning perspectives).

On a broader scale, the learners would be able to investigate sets of meaning schemes (points of view) to arrive at a larger world view of technology and its place in the teachers' social roles (habit of mind). In short, the theoretical implications of transformative learning have clear connections to teaching and learning processes.

Methodological

The mixed-methodology approach used in this study (Tashakkori & Teddlie, 1998, 2003) allowed for quantification of the data for comparative purposes as well as qualification of the responses. In short, the study was tight and significant in its design because of the careful adherence to Tashakkori and Teddlie's (1998, 2003) mixed-methodology principles. The mixed-methodology approach could maximise findings in future transformative learning studies that use the theory to drive the research questions and utilise the strengths of qualitative methods to address the weakness of quantitative research methods and vice versa.

As well, the complementarity achieved by the action plans and the four data sources maximised reliability that elements of transformative learning could be extracted from the results. The action plan led to the reflective journal; the teacher questionnaire informed the semi-structured interview; and my field notes filled in gaps among the other data instruments. That is, each data source added to and expanded on the other data sources so that the pooled data revealed significant results in relation to the degree of perspective transformation and factors related to perspective transformations. This complementarity across data sources could prove useful in other transformative learning studies.

The initial action plan allowed the teachers the opportunity to decide what specific technologies they wanted to learn, how quickly they wanted to achieve success, who would assist them in their plan, who would discuss issues with them, and what mastery indicators would be present at completion of the action plan. This instrument acted as a “disorienting dilemma” for the learners as they had to carefully consider the action plan, their assumptions about learning, and with whom they would critically discourse. Additionally, the professional development plan acted as a measurement tool to record who completed their plans and allowed comparison between who successfully completed and the degree of perspective transformation (see “Transformative Learner of Technology”).

The next phase was to provide an instrument that chronicled their technology development in the form of a reflective journal. This data source had the added benefit of providing a written record of their transformative journey in an asynchronous setting so that the teachers could read through and back over their months of technology descriptions and email them to me. It also acted as a medium to address specific reflective questions and activities, a defensible andragogical strategy

(Cranton & King, 2003), which I asked after the professional development workshops. For instance, after a workshop on KidPix, the teachers were encouraged to record their thoughts on the utility of using the software program in their respective classrooms. It should be noted that only one teacher, A – 3, actually used my email questions as a focus for discussion and, potentially, for a perspective transformation so I am confident that the asking of questions did not necessarily lead to perspective transformations but might have acted as a springboard for discussion by the participants.

The second data source, the teacher questionnaire, also provided reflection time for each teacher; however, the statements were structured so that the teachers were responding to my ideas rather than to their own.

The semi-structured interview, based on the journal entries and the questionnaire responses, acted as a real-time instrument so that I was able to capture the thoughts of the teachers as they became available rather than allowing them time to articulate their experiences as was done with the reflective journals.

Lastly, my field notes provided a vehicle for spontaneous comments from the teachers as well as researcher reflections. There were instances when the teachers provided informal comments that became invaluable in describing their perspective transformations.

As this methodology of combining and overlapping data instruments worked particularly well for describing the teachers' transformative journeys, it may be instrumental in extracting transformative learning elements in future studies. In other words, as in the study, if one of the sources were omitted, valuable and valued data could be missing; however, the concatenation and augmentation of data would prove effective in detecting subtle transformative learning elements.

Andragogical

Given that transformative learning is, and was originally designed as, an adult learning model, there are several implications for the teaching of adults, especially in technology professional development.

First, the results of this study have shown that the best way to teach adults about technology is to provide the learners with a pre-assessment instrument such as the action plan. By gauging what teachers want to learn, they feel empowered and respected for their learning; however, they also become more conscious of what they believe and what they realistically want to accomplish.

Second, it is critical to have a technology facilitator who in-services the teachers, provides support when needed, and returns for follow-up feedback on their needs. In this manner, a facilitator will have a better chance of effecting change vis-à-vis perspective transformations.

Third, the design of the researcher interventions provided support to the teachers (see Table 14, Chapter 3). The just-in-time email messages, on-line discussions, telephone conversations, downloadable tutorials, and face-to-face workshops created a strong blended learning model (Rossett, Douglis, & Frazee, 2003; see Chapter 2) that increased the likelihood of success in the teachers' completion of their professional development action plans.

Fourth, and equally critical, the facilitator cannot be a person who teaches in the school. In short, the teacher might withdraw causing no change in point of view. All 10 participants commented on that feeling that frustration, anxiety, and tension tended to surface more quickly at the school level and that the teachers became embittered quite quickly. They stressed the value of having someone outside the school assist them with their technology development. In most cases, that person was me; however, several teachers (A – 1; A – 4; B – 1; B – 2; C – 1; C – 3) provided responses related to assistance from colleagues in other schools, friends, and family.

Fifth, the androgogue needs to understand the related adult learning principles of empowerment, autonomy, and collaboration as well as transformation learning theory. This awareness of how adults learn would certainly lead to changed habits of mind in the participants—as evidenced by the 10 teachers in this study.

Lastly, it is the professional development facilitator's role to provide opportunities for the adult learners to communicate with each other and time to reflect so that perspective transformations are not "epochal … [and] … painful" (Mezirow, 1985, p. 24). The learners need settings where they can engage in critical discourse with like-minded individuals about educational technology and time to critically reflect on their assumptions about learning educational technology.

Conclusion

The school culture, as an external factor, influenced the occurrence of perspective transformations. The participants who worked within a culture regime of a collaborative culture and a contract regime of a professional learning community (i.e., School A), with the exception of A – 3 (see Table 23), described the most transformative learning experiences in comparison to contrived collegiality and performance training sects (i.e., School B) and permissive individualism and corrosive individualism (i.e., School C) (see Table 20).

There were factors that promoted and impeded the occurrence of perspective transformations. All 10 participants in my study stressed the importance of collaborating with colleagues – inside and outside their schools – in order to complete their professional development action plans. Six worked with other colleagues in the doctoral study while four collaborated with teachers inside and outside the school who shared similar interests with those teachers. Other factors which promoted perspective transformations were administrator support, time, and targeted funding (see Table 21).

In contrast, the strongest deterrent for their experiencing a perspective transformation was working with a colleague who was overbearing, authoritative, and dictatorial in nature, that is, a gauleiter. The participants emphasised that their learning processes were retarded or ceased when they encountered such an individual. Therefore, any positive alteration in meaning scheme or perspective was not forthcoming (Mezirow, 2000) unless precipitated by an outside facilitator. The remaining factors which deterred the occurrence of perspective transformations were a weak infrastructure and administrator pressure (see Table 21).

The research findings demonstrated that teachers experienced a perspective transformation as they acquired educational technology skills. The teachers were able to describe their transformative learning experiences in rich detail. I categorised those descriptions into their respective clusters of meaning schemes, meaning perspectives, frames of reference, varying habits of mind, points of views, and critical reflection on and critical self-reflection of assumptions (see Figure 8). It is evident that there is a strong relationship between the external factors and the individual perspective transformation themes as the latter derives from the former.

Transformative learning proved a viable research framework to describe these 10 teachers' experiences in the use, integration, and teaching of technology. The participants in my study indicated in their reflective journal entries, on the Learning Activities Survey – Professional Development in Technology questionnaire, in the semi-structured interview, and through comments to me that the theoretical framework allowed them to experience collaboration on various levels, empowerment, and autonomy. In fact, the participants indicated that this research framework was a powerful and necessary professional development model, in general, and in educational technology, in particular.

It is clear that a "working profile" of a transformative learner of technology can be purported. The converging data from the participants who articulated the most transformative learning statements led to a series of characteristics that described transformative learners of technology. They are collaborative and, most likely, female, teachers who work with teachers, administrators, and students to deliver a strong technology program. The transformative learners are open minded and independent minded so that they are willing to learn new information but also need to decide what aspects of that information is useful and what can be rejected. They also set clear priorities for teaching and learning so that little or no time is wasted in the learning processes. The transformative learners of technology seize presented opportunities so that direct initiative is taken. They have experience in the form of curricular changes but not necessarily are they older teachers. The transformative learners of technology possess a clear disposition for change and understand the necessity of altering their respective points of view and habits of mind.

The adapted version of the Learning Activities Survey – Professional Development in Technology questionnaire (see Appendix A) worked well in identifying whether the 10 participants had experienced a perspective transformation as they responded to the 11 statements of the questionnaire and included written comments about their educational technology experiences in the open-ended section of the Learning Activities Survey – Professional Development in Technology questionnaire. As well, the 11 statements (King, 2002a, 2002e) that corresponded to Mezirow's (1991a) 11 stages of transformative learning allowed me to code the written data in relation to those statements, thereby demonstrating an innovative use of King's original statements.

The research findings also supported the journey of transformation (King, 2002a, 2002e) (see Table 6 in Chapter 1) and its related four phases as the teachers described their initial feelings of trepidation and resistance (Fear and Uncertainty) to educational technology. As well, their experimentation with role changes and action to be taken (Testing and Exploring) were clearly represented in their comments. Their trying out of new roles and gaining competence and confidence (Affirming and Connecting) were major parts of the transformative journey. Lastly, their adoption of the new roles and a new outlook to their learning (New Perspectives) were evident as the participants described their altered frames of reference.

There are definite implications for theory, methods, and teaching in relation to transformative learning and educational technology. From a theoretical perspective, the data from my study appear to indicate that transformative learning is a viable research framework to describe teachers' development in educational technology. As well, the elements of transformative learning (e.g., disorienting dilemma, perspective transformation, meaning scheme, meaning perspective, critical self-reflection, habits of mind, and points of view) are suitable descriptors of technology development. From a methodological perspective, Tashakkori and Teddlie's (1998, 2003) mixed-methodology principles strengthened my study by allowing for quantification and qualification of the data while ensuring that the whole experience of the participants (e.g., action plans, levels of intervention, research tools, and contract and culture regimes) was examined in relation to their perspective transformations. From an andragogical perspective, the data from my study appear to indicate that pre-assessing the learning of the teachers is critical to their learning so that they can not only feel empowered but also could become more aware of their meaning schemes and perspectives as they gauge their success.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

The aim of this research study was to investigate the educational technology development of elementary school teachers through the lens of transformative learning theory. While technology infusion has been well documented in the last decade (Bitter & Pierson, 1999; Chen, 2002; Ely & Plomp, 1999; Grabe & Grabe, 2000; Heide & Henderson, 2001; Heide & Stilborne, 1999; Jonassen, 2000; Mills & Ragan, 2000; Norton & Wiburg, 1998; Roblyer, 2003a, 2003b; Schwartz & Willing, 2001; Tomei, 2002; Valmont, 2003) and myriad studies have investigated transformative learning in adult learning (Cranton, 1994, 1996; Cranton & King, 2003; Cranton & Roy, 2003; King & Lawler, 2003; McWhinney & Markos, 2003; Mezirow, 1981, 1989, 1990, 1991a, 1991b, 1992, 1994a, 1994b, 1995, 1996, 1997, 1998, 2000, 2003; Taylor, 1997, 1998), few researchers have attempted to delineate the elements of teachers' perspective transformations as they reflect on their educational technology frames of reference (Benson, Guy, & Tallman, 2001; King, 2001, 2002a, 2002b, 2002c, 2002d, 2002e,2003; LaCava, 2002).

On the basis of the data presented here, teachers experience, through critical reflection of assumptions and critical self-reflection on assumptions, varying changes in their meaning schemes and perspectives due to their technology development (Research Question 1a). There also appear to be specific factors related to perspective transformations that promote or impede perspective transformations due to teachers' use, integration, and teaching of educational technology (Research Question 1b). Transformative learning theory proved a defensible research framework to describe teachers' development in educational technology (Research Question 2). The theory is extremely complex and involves many inter-related facets of transformation that would prove useful in articulating how teachers develop as they use, integrate, and teach educational technology.

The structure of this chapter is divided into four sections. The first section restates the first part of Research Question One and provides summary evidence to demonstrate the degree of perspective transformation experienced by the 10 teachers in this study. The second section restates the second part of Research Question One and re-presents the data in relation to the factors related to perspective transformation. The third section restates Research Question Two and presents an argument for using transformative learning as a viable research framework to investigate the technology development of the 10 teachers in this study. The fourth, and last, section outlines recommendations for future research.

Research Question One

Given professional development opportunities consistent with sound andragogy, to what degree do teachers experience a "perspective transformation" due to their development in technology?

According to the most up-to-date definition, transformative learning "is learning that transforms problematic frames of reference—sets of fixed assumptions and expectations (habits of mind, meaning perspectives, mindsets)—to make them more inclusive, discriminating, open, reflective, and emotionally able to change" (Mezirow, 2003, p. 58).With this definition in mind, the data were thematically re-organised into five key elements of transformative learning and perspective transformation.

Critical reflection of assumptions and critical self-reflection on assumptions are argued to be paramount to a person experiencing a perspective transformation

(Cranton, 1994; Cranton & Carusetta, 2004; King, 2002e; Mezirow, 1998, 2000). Based on the fact the most frequent responses from the teachers (40.9%) related to the theme of critical reflection, I have confirmed that critical reflection was the most important part of the process for the teachers in this study. The element of describing revised frames of reference was endemic in the transformative learning statements which supports the argument of how crucial this element is to breaking away from the constraining psycho-cultural assumptions (Mezirow, 1981) about educational technology held by the teachers in this study. A necessary part of a perspective transformation is to experience a change in meaning schemes and perspectives (King, 2003a; La Cava, 2002; Mezirow, 2003). There were myriad examples of the teachers describing altered meaning schemes and perspectives which reinforces the argument that they consider "the structure of cultural and psychological assumptions within which [their] past experience assimilates and transforms new experience" (Mezirow, 1985, p. 21). The disorienting dilemma is the necessary catalyst for a perspective transformation and there were many instances of these catalysts being described by the teachers, most of which occurred at the stage of completing their professional development action plans. Lastly, there was evidence of Mezirow's (1985) types of learning (instrumental; dialogic; self-reflective) and Mezirow's (1985) three learning processes of learning within present meaning schemes, learning new meaning schemes, and learning through meaning schemes. There were, or 10.9% of the overall, comments offered related to this transformative learning statement. In short, the research data showed that teachers experience a perspective transformation, in varying degrees, related to their development in technology.

What factors and personal characteristics external to the professional development program appear to promote or impede their perspective transformation?

In order to answer this second part of the Research Question One, I pooled all the comments from the four data sources, extracted key words and phrases, and analysed the data. In particular, I examined the relationship between the indicators of transformative learning and the teachers' contexts to see if there were any patterns of promoting and deterring factors related to perspective transformations.

The highest-ranked factor that promoted perspective transformations for the participants in this study was collaboration. All the teachers described the need to work with others within the school, district, and province so that they could learn more about technology infusion. On the other hand, having someone who makes a teacher feel inferior or overpowered, a gauleiter, was the highest-ranked factor that impeded a perspective transformation. In the words of one teacher, "when you work with colleagues to meet a common goal, you feel empowered … [but] when you have someone who makes you feel stupid, you are disempowered" (A – 4, field notes). The second-ranked factor that assisted teachers in changing their meaning schemes and perspectives was positive support from the administration. It was deemed extremely important from the teachers to know that they had an administrator who would not only devote time and funds for their technology needs but also would be part of the learning process. The teachers felt equally strongly that without the necessary infrastructure in place, they would be impeded from experiencing a perspective transformation. Teachers also believed that they needed practice time to learn the new skills and strategies, to discuss projects and ideas with colleagues, and to investigate best practices in other classrooms and schools. Having pressure from the administration to develop in technology was seen as a deterrent and impeded the teachers from changing their meaning schemes, meaning perspectives, and habits of mind. Lastly, the need for better use of funds was described as much more important than having more money in their experiencing a perspective transformation. In other words, the teachers wanted to have direct input into how technology funds were used rather than merely receiving a large quantity of money with no goal for its expenditures.

In short, in answer to the second part of Research Question One, I have demonstrated that, for the teachers in this study, four factors promoted and three factors impeded the occurrence of perspective transformations in teachers as they use, integrate, and teach technology. These seven factors could prove useful in further studies on transformative learning. My findings confirm other researchers' general findings that people (King, 2002a, 2002e; LaCava, 2002) (i.e., collaboration; administrator support) and discourse with peers (King, 2000a, 2002a, 2002e; LaCava, 2002) (i.e., collaboration; time) are facilitating factors in perspective transformation. As my study appears to be the first perspective transformation study to examine factors within a school setting (e.g., administrator support; targeted funding) and to examine impeding factors (e.g., gauleiter; infrastructure; administrator pressure), comparison with other perspective transformation studies was not possible.

Research Question Two

Is transformative learning a viable research framework to describe the teachers' development in technology use, integration, or teaching?

In order to answer this question, I examined each of the four data sources using the 11 Learning Activities Survey – Professional Development in Technology statements and related NVivo codes outlined in the previous chapter (see Table 8, Chapter 2) in order to extract the transformative learning elements of disorienting dilemma, altered meaning schemes and perspectives, revised frame of reference, types of learning and learning processes, and critical reflection (see Figure 8 & Table 22, Chapter 4) from the research data. Given that perspective transformation is subtle, the robust nature of the analysed responses provided in the reflective journals, teacher questionnaire, semi-structured interview, and my field notes and my comprehensive analysis of the data allowed opportunity to isolate examples of each element in the form of participant comments. The data from the four sources provided the basis for my comprehensive analysis of the data and the structure of the data was based on the transformative learning framework. Without the rich data from the complementary data sources on which the analysis was based, the opportunity to highlight the elements of such a robust research framework might have been missed.

Additionally, this was confirmed by the 10 participants who, in response to a final interview question, indicated that the conceptual framework derived from transformative learning theory had, from their perspective, been a useful framework for the research design. Nine commented on the importance of its emphasis on working with other colleagues; others elaborated on the notion of empowerment espoused by the theory; and many outlined the significance of its autonomy aspects. By and large, all argued that the stress on critical self-reflection was a major strength of the theory. I acknowledge that, without a thorough analysis of transformative learning by the participants, their responses to this question might be uninformed. However, their responses conformed to Cranton's (1994) four stages of learner empowerment: initial learner empowerment, critical self-reflection, transformative learning, and autonomy (see "Transformative Learning as a Research Framework" section, Chapter 4) which appeared to demonstrate that they intuitively knew more about the theory than they might have been aware. In short, it is my position that there is sufficient data to support a positive response to the question: Is transformative learning a viable research framework to describe the teachers' development in technology use, integration, and teaching.

Recommendations for Future Research

There were seven recommendations that resulted from the lessons learned in this research study on transformative learning and educational technology.

Theoretical

1. This study involved 10 participants who were keen on learning more about educational technology. A future study could research the educational technology experiences of all teachers in one school or several schools so there would be an opportunity to investigate the viability of transformative learning where the teachers represent a cross-sample of experience with educational technology to include, but not be limited to, innovators, resistors, novices, and experts.
2. More studies need to examine the degree of perspective transformation in educational technology in an in-depth manner. The few studies that have investigated the two areas (Benson, Guy, & Tallman, 2001; King, 2001, 2002a, 2002b, 2002c, 2002d, 2002e, 2003; LaCava, 2002; Whitelaw, Sears, & Campbell, 2004) have proven the presence of perspective transformations; however, my study appears to be the first that demonstrates not only the presence but also the degree of perspective transformations experienced by teachers as they use, integrate, and teach educational technology.

3. Many of the teachers commented on gender as a technology-related factor. Every participant described a female teacher with whom they collaborated; however, every respondent indicated that a male teacher was the technology innovator who had influenced them—positively or negatively. A future study could investigate whether gender is an issue in technology innovation and in technology collaboration.

Methodological

4. I would have preferred to spend more time with the teachers training them to use, integrate, and teach technology with and to their elementary-aged students. Although I consistently offered one-on-one tutorials and group workshops, few teachers could attend due to time commitments and school-related initiatives. As one teacher summed up: “Your skills were appreciated but underused…. For me, the spirit was willing but the flesh (and the administration) resisted” (C – 1). In a future study, more concrete guidelines must be set for attending workshops over a longer period of time—four to six months—so that more long-term commitment can be attained from the teachers. As well, this dedication to attend the workshops may cause teachers to realise a higher level of competence and confidence with educational technology, in particular, and become more comfortable with the traditional social expectations of teachers as technology users, in general.
5. On the one hand, the Learning Activities Survey – Professional Development in Technology was a useful instrument for indicating the existence of perspective transformations and for allowing opportunities for pointed questions during the semi-structured interview. On the other hand,

seven of the 10 teachers expressed a degree of frustration at the statements listed in Question Three as they found them to be difficult to understand. To this end, it is recommended that the Learning Activities Survey – Professional Development in Technology have a clear explanation of the implied meaning for each statement or an example of the situation which dictates the occurrence.

Andragogical

6. The design of the professional development model utilised in this study combined the principles of adult learning (Apps, 1991; Caffarella, 1994; Cranton, 1994, 1996; Galbraith, 1998; Holzberg, 1997; Kemp & Cochern, 1994; King, 2000; Lawler, 1991; Lawler, 2003; Lawler & King, 2000; Moran, 2001), blended learning (Rossett, Douglis, & Frazee, 2003) and situated learning (Herrington & Herrington, 2004; Herrington & Oliver, 2000) which resulted in collaboration which, in turn, led to a great deal of critical reflection by the 10 participants. A future study could examine if there are particular changes that could be made to the professional development model that would address additional elements of transformative learning which could support the findings of this study.
7. Transformative learning, in particular, should be an integral part of teacher education programs so that the professors understand the advantages of such a theory. If the pre-service teachers are expected to understand how to effectively teach children, it makes infinite sense that the adult educators should understand how to effectively teach their students (Alstete, 2000; Cranton & King, 2003; King & Lawler, 2003; Lawler & King, 2003). In other words, teachers who teach adults should have a

better understanding of how adults learn so that the educators can teach their students more effectively.

Conclusion

Using transformative learning theory as the theoretical framework, the aim of this study was to research the ICT development of elementary school teachers. The two research questions that supported the aim of this study were: (1) *Given professional development opportunities consistent with sound andragogy, to what degree do teachers experience a "perspective transformation" due to their development in technology? What factors and personal characteristics external to the professional development program appear to promote or impede their perspective transformation?* and (2) *Is transformative learning a viable research framework to describe the teachers' development in technology use, integration, or teaching?*

Chapter 1 reviewed the professional literature on transformative learning from a variety of approaches. The chapter commenced with a discussion of Mezirow's (1978a, 1978b, 1981) early development of the theory who was influenced by Kuhn's (1962) paradigm, Freire's (1970) conscientization, and Habermas' (1971) domains of learning. As the theory was novel and untested, there were challenges (Clark & Wilson, 1991; Collard & Law, 1989; Tennant, 1993) and rebuttals (Mezirow, 1989, 1991b, 1994a) which are summarised in this chapter. Mezirow's (1978a, 1978b, 1981) original theory evolved over 25 years and included revisions to the theory that reflected adult-learning principles. Chapter 1 continues with a discussion of the practical applications of transformative theory that provides further evidence for its importance in adult learning and teaching (Cranton, 1994; King, 1997a) and in the professional development of adults (Apps, 1991; Caffarella, 1994; Cranton, 1996; Cranton & King, 2003; Galbraith, 1998; Kemp & Cochern, 1994; King, 2000, 2002a, 2002e; 2003; King & Lawler, 2003; Lawler, 1991, 2003; Lawler & King, 2000, 2003; Merriam & Caffarella, 1999; Taylor, Marienau, & Fiddler, 2000). The relationship between the concept of technology innovation and school change (Bates, 2000; George & Camarata, 1996; Fullan, 1999, 2001a, 2001b; Fullan & Hargreaves, 1996; Hargreaves, 2003; Means & Olson, 1995; Means, Penuel, & Padilla, 2001; Pegrum & Anderson, 1999; Sandholz, Ringstaff, & Dwyer, 1997; Schofeld & Davidson, 2002; Stuve, 1997) was explored as transformation of the individual and the culture are important corollaries to perspective transformation (Mezirow, 1997, 2000). In this study, specific emphasis was placed on the research of King and LaCava as their research provided guidance to this study. My study supported and added to their and others' previous research (Benson, Guy, & Tallman, 2001; King, 1997b, 2000, 2003, 2004; LaCava, 2002; Whitelaw, Sears, & Campbell, 2004).

Chapter 2 described the research paradigm used for this study, the mixed-methodology approach (Cresswell, 1995, 2003; Reichardt & Rallis, 1994; Tashakkori & Teddlie, 1998, 2003), as it combined qualitative and quantitative research methods. The qualitative method was effective for the coding and categorisation of the rich responses from the 10 participants. The quantitative approach allowed for the use of frequency counts to characterise the degree of perspective transformation and the specific factors related to perspective transformations as well as to ascertain any statistically-significant differences between the public and independent schools. So that a context for interpretation could be set, the backgrounds of the schools and of the 10 teachers were outlined. The data revealed that each of the three schools possessed a specific culture and regime (Hargreaves, 1994, 2003) which appeared to have promoted perspective transformations in educational technology for some of the participants. The data collection methods were described to evidence that they were thorough, varied, confirmatory, and complementary.

Chapter 3 outlined the research findings based on the myriad quotes and responses from the participants as articulated in the reflective journals, teacher questionnaire, semi-structured interview, and the researcher field notes. The treatment of the findings was systematic as each research question was re-stated and the supporting data were outlined. The quotes exemplified specific transformative learning elements. In addition, the differences among the three schools and between the school-types were highlighted with particular emphasis on the perspective transformations experienced by the individuals in the respective schools.

Chapter 4 answered the three research questions. To provide a specific context for understanding, differences between and among the three schools were presented initially. Using Hargreaves' (2003) research on school cultures, the respective school environments in which the perspective transformations occurred were described. As the Chapter 3 data revealed, perspective transformations occurred for some teachers due to their development in educational technology but occurred minimally for others. For this reason, detecting which systemic external factors contributed to or impeded perspective transformations was critical. In this chapter, I posited seven potential factors related to perspective transformation and therefore provided evidence for affirmatively answering the second part of Research Question One. To address the first part of Research Question One, the data from Chapter 3 (see Tables 11, 13, and 15) were re-categorised into five themes to further report on the degree of perspective transformation experienced by the 10 participants. This degree of perspective transformation was discussed using five elements of transformative learning as key themes: (1) disorienting dilemma, (2) altered sets of meaning schemes and perspectives, (3) revised frames of reference, (4) types of learning and learning processes, and (5) critical reflection of and critical self-reflection on assumptions. Demonstrating whether transformative learning theory was a viable research framework that described the teachers' development in technology use, integration, or teaching was important so that other researchers could use this framework with assurance of maximised reliability and credibility. Therefore, Chapter 4 described the re-organisation of the data into Cranton's (1994) four stages of learner empowerment as they were robust and representative of andragogy and transformative learning: initial learner empowerment, critical self-reflection, transformative learning, and autonomy. As well, the characteristics of a "working profile" of a transformative learner of technology were described which appeared to contribute to the literature in the three fields of transformative learning, educational technology, and adult professional development. Chapter 4 concluded with the theoretical, methodological, and andragogical implications.

This chapter, Chapter 5, outlined conclusions from the study by re-presenting the research questions and providing a summary of the findings in relation to those questions. As well, theoretical, methodological, and andragogical recommendations for future research were provided.

In sum, transformative learning theory is extremely complex and involves many inter-related facets of transformation that proved useful in articulating how teachers develop as they use, integrate, and teach educational technology. The findings proved that the teachers, in this study, experienced, through critical reflection of assumptions and critical self-reflection on assumptions, varied, and varying alterations in their, meaning schemes, meaning perspectives, and frames of reference due to their technology development (Research Question 1a). This study also demonstrated that there were specific systemic external factors that promoted or impeded perspective transformations due to teachers' use, integration, and teaching of educational technology (Research Question 1b). A further conclusion was that transformative learning theory proved a defensible research framework to describe teachers' development in educational technology (Research Question 2). This study appears to have contributed to the professional literature, demonstrated the strength of the professional development model used, and informed practice in adult development in educational technology.

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APPENDIX A

ADAPTED LAS – PD – TECH

LEARNING ACTIVITIES SURVEY: PD TECHNOLOGY FORMAT-HE*

Name: ________________

The purpose of this survey is to explore the experiences of teachers as they learn to use computers and technology for instructional purposes. The survey only takes a short time to complete, and your responses will be confidential.

1. Since you have been learning about technology, do you believe you have experienced a change in your teaching because of learning about and using technology?

   Yes □ No □

2. If yes, briefly describe this change.

3. Some statements that could describe aspects of this change are listed here. Thinking about your experiences in educational technology learning, please check off any statements that may apply.

□ I had an experience that caused me to question the way I usually act.

□ I had an experience that caused me to question my ideas about social roles.
(Examples of social roles include what a teacher should do or how a mother or father should act.)

□ As I questioned my ideas, I realized I no longer agreed with my previous beliefs or role expectations.

□ I realized that other people also question their beliefs.

□ I thought about acting in a different way from my usual beliefs and roles.

□ I felt uncomfortable with traditional social expectations of teachers.

□ I tried out new roles in teaching so that I would become more comfortable or confident in them.

□ I tried to figure out a way to adopt these new ways of acting.

□ I gathered the information I needed to adopt these new ways of acting.

- □ I began to think about the reactions and feedback from my new behaviour from others.
- □ I took action and adopted these new ways of acting.
- □ I do not identify with any of the statements above

4. If you have experienced a change in your perspective about technology and teaching (i.e., checked any of the first ten boxes above), please continue with question 5. If you have not experienced such a change (i.e., checked the last box above), please proceed to question 7.

5. Thinking back to when you first realized that your views or perspective had changed, what did learning about technology have to do with it?

6. Some possible contributors to such change are listed below. Please check off all those which may have played a part in this change of perspective.

   Was it part of this research project that influenced the change?

   Yes □ No □

   If "Yes," what was it? (Check all that apply)

□ Group project	□ Class discussion
□ Writing about your concerns	□ Assigned challenge
□ Personal or electronic journal	□ Student teacher
□ Nontraditional structure of a workshop	□ Workshop activity/exercise/worksheet
□ Lab experience	□ Assigned reading
□ Action plan	□ Independent personal reflection
□ Other: ____________________	

Was it a change in your teaching situation? (Check all that apply)

□ New computers	□ New individual classroom computers
□ New computer lab	□ New technology support
□ New leadership	□ New teaching assignment (grade)
□ New curriculum	□ New teaching assignment (location)
	□ Other: ____________________

Was it a person who influenced the change? □ Yes □ No

If "Yes," was it…. (Check all that apply)

□ A fellow participant's support	□ A student's support

□ The researcher's support □ A challenge from the researcher
□ Other: ____________________

If none of these applied, what do you think contributed to the change?

7. Which of the following has been part of your experience in this professional development program? (Please check all that apply.)

□ Group project
□ Writing about your concerns
□ Personal or electronic journal
□ Nontraditional structure of a workshop
□ Lab experience
□ Action plan
□ Other: ___________________
□ Class discussion
□ Assigned challenge
□Student teacher
□Workshop activity/exercise/worksheet
□ Assigned reading
□Independent personal reflection

Which of these have occurred during this time? (Check all that apply)

□ New computers
□ New computer lab
□ New leadership
□ New curriculum
□ New individual classroom computers
□New technology support
□ New teaching assignment (grade)
□ New teaching assignment (location)
□ Other: ___________________

Other comments:

APPENDIX B

INFORMED CONSENT FORM

INFORMED CONSENT FORM

PRINCIPAL INVESTIGATOR	*Dr. Andrew Kitchenham*
PROJECT TITLE:	*Teachers and technology: A transformative journey*
SCHOOL	*JCU School of Education*
CONTACT DETAILS	Faculty of Education, *Tel (* *Fax* *Cell* *Email:* *Alt email:* *Alt email:*

DETAILS OF CONSENT:

This doctoral study will investigate the technology experiences of British Columbia urban elementary teachers. As a participant, I will ask you to complete a one-page professional development technology growth plan that outlines what you would like to learn, how soon and how long you would like the learning to occur, and the measure of your success. Next, you will be invited to take part in technology workshops or one-on-one tutorials or model lessons (or all three). You will be asked to record your feelings, thoughts, and questions in a reflective journal on a weekly basis. In addition, I would like you to complete a brief, 4-page questionnaire that requires responses to specific statements. Lastly, I would like to interview you for 30 to 60 minutes at the school site. The guiding interview questions will be based on your responses to the questionnaire and the interview will be audiotaped. That interview will be transcribed and returned to you so that you can ensure that the comments are an accurate representation of what was articulated.

When the Ph. D. dissertation has been approved by James Cook University (Townsville, Queensland, Australia), a copy will be sent to the Superintendent of Schools and to the principal or Head of your school.

CONSENT

The aims of this study have been clearly explained to me and I understand what is wanted of me. I know that taking part in this study is voluntary and I am aware that I can stop taking part in it at any time and may refuse to answer any questions.

I understand that any information I give will be kept strictly confidential and that no names will be used to identify me with this study without my approval.

Name: *(printed)*	
Signature:	**Date:**

APPENDIX C

TECHNOLOGY FAÇADE CHECKLIST (SCHOOL A)

Technology Facade Checklist

Instructions: Complete each of the following questions by entering the most appropriate response and transferring the points to "Your Score."

THE USE OF TECHNOLOGY

School districts plan to spend more on technology in the upcoming years, the largest planned increase since technology was formally recognized in our schools over four decades ago. Are the key players in your school coming on board? Answer items 1-6 to assess the extent of technology use in your school. Total available points for this section of the Checklist is 55.

1. Are the technologies in your school used by classroom teachers, or is the computer teacher the only educator who dispenses technology-related instruction? Select one. ***(You can find out more about this question in Chapter 3.)***

	Points Available	**Points Awarded**
Computer teacher only	1	
A few teachers use technology, but not regularly	3	
A few teachers use technology routinely	5	
Technology is routinely used by many classroom teachers	7	7
Your Score (7 possible)	➔	7

2. Are the computer facilities in your school…? Select one. ***(You can find out more about this question in Chapter 3.)***

	Points Available	**Points Awarded**
Locked during unsupervised periods such as recess, study halls, lunch, and before and after school	0	
Available before and / or after school	3	3
Available when there are no classes scheduled	5	
Open during recess, study halls, lunch, and before and after school.	7	
Your Score (7 possible)	➔	3

3. School computers are located in our…: Select all that apply. ***(You can find out more about this question in Chapter 3.)***

	Points Available	Points Awarded
Library	1	1
Classrooms	3	3
Computer lab	3	3
Your Score (7 possible)	➔	7

4. Do classroom teachers use technology for …? Rate each separately. ***(You can find out more about this question in Chapter 4.)***

	Points Available				
	Never	**Seldom**	**Occasionally**	**Routinely**	**Points Awarded**
Grading	0	1	3	5	3
Lesson preparation	0	1	3	5	3
Out-of-class assignments	0	1	3	5	3
Professional development	0	1	3	5	3
Your Score (20 possible)	➔	➔	➔	➔	12

5. Is the computer teacher expected to have lesson plans with specific student learning objectives related to technology competencies? Select one. (*You can find out more about this question in Chapter 4.)*

	Points Available	Points Awarded
Computer instruction is not based on lesson plans	0	
Lesson plans are not used. There are general goals for instruction, but no specific learning objectives	1	
Lesson plans contain generic technological competencies and general learning objectives	3	3
Detailed lesson plans are used that reflect specific technological competencies expected of each student	7	
Your Score (7 possible)	➔	3

6. Does the software found on your computers reflect current classroom curriculum? Select one. (*You can find out more about this question in Chapter 5.)*

	Points Available	Points Awarded
Computer software is available, but its selection was not based on teacher input and seldom reflects actual classroom content	1	
Computer software was recently purchased but is not readily available for teachers and students to use	3	
Computer software selection was based on teacher input and its use on current curriculum objectives	5	6
Computer software versions are current, software selection is based on teacher input, and the software is routinely used by teachers and students	7	
Your Score (7 possible)	➔	6

7. What is the extent of technology training received by teachers? Select all that apply. ***(You can find out more about this question in Chapter 6.)***

	Points Available	Points Awarded
Initial training over 6 months old	0	0
Initial training only within the last 6 months	1	
In-service training on technology at least twice a year	3	
At least two teachers per school are encouraged to enrol in formal instructional technology programs	3	
Training classes available on demand, scheduled with the technology coordinator	5	
Your Score (12 possible)	➔	0

8. Do teachers participate on the Technology Committee and its subordinate teams? Identify all that apply. ***(You can find out more about this question in Chapter 6.)***

	Points Available	**Points Awarded**
Teachers do not participate as full voting members	0	
Teachers participate as members of the Hardware/Software Acquisition Team	3	
Teachers participate as members of the Technology Budget Preparation Team	3	
Teachers participate as members of the Instructional Technology Curriculum Team	5	
Teachers participate as members of the Strategic Technology Planning Team	5	
Your Score (16 possible)	➔	0

9. Do parents, community leaders, alumni, and students participate on the Technology Committee and its subordinate teams? Identify all that apply. ***(You can find out more about this question in Chapter 6.)***

	Points Available	**Points Awarded**
They do not participate as voting members	0	0
They participate as members of the Hardware/Software Acquisition Team	3	
They participate as members of the Technology Budget Preparation Team	3	
They participate as members of the Instructional Technology Curriculum Team	5	
They participate as members of the Strategic Technology Planning Team	5	
Your Score (16 possible)	➔	

10. Does your school provide direct access to the following technology professionals? Identify all that apply. ***(You can find out more about this question in Chapter 6.)***

	Points Available	Points Awarded
None of these professionals are employed in our school	0	
Computer teacher (Part time/Full time)	3/7	5
Technology coordinator (Full time only)	5	
Computer technician (Part time/Full time)	1/3	1
Network administrator (Full time only)	3	
Your Score (18 possible)	➔	6

11. How is technology funded in your school? Select one. ***(You can find out more about this question in Chapter 7.)***

	Points Available	Points Awarded
Technology is funded with year-end fallout money	1	
Technology is included in the operating budget under a miscellaneous account	3	
Technology is included in the general operating budget	5	5
Technology is its own specific, recurring line item in the annual budget	7	
Your Score (7 possible)	➔	5

12. Has your school implemented a recognition program for teachers who develop technology-based instructional materials? Select one. ***(You can find out more about this question in Chapter 7.)***

	Points Available	Points Awarded
There is no remuneration or recognition program to recognize excellence in instructional technology	0	
Excellence in instructional technology is recognized in school newsletters, bulletins, and school board reports	1	1
A formal awards program recognizes teachers who develop excellent instructional technology programs	5	

Teachers receive compensatory time, monetary compensation, or other specific remuneration for developing technology-based programs	7	
Your Score (7 possible)	➔	1

13. Is there a technology plan for the school? Select one. ***(You can find out more about this question in Chapter 8.)***

	Points Available	**Points Awarded**
No technology plan exists in our school	0	
The school is working under a general district wide plan, but a local building plan does not exist	1	
The school is working on a informal strategy for technology, but a formal plan has not been prepared	3	
Yes, but it is in serious need of revision or has not been revised in the previous 2 years	5	5
Yes, and it is revised on a regularly scheduled basis at least annually	7	
Your Score (7 possible)	➔	5

14. Does your school's Technology Plan contain the following? Identify all that apply. ***(You can find out more about this question in Chapter 8.)***

	Points Available	**Points Awarded**
No technology plan exists in our school	0	
Vision/mission statement	1	1
Demographic review of teachers, students, and community	1	1
Technology-related purchasing procedures	1	
Periodic and on-call maintenance for instructional technologies used for classroom teaching	1	1
Security plan regarding physical threats, human threats, and Internet threats to technology	1	1
Formation and operation of a viable technology committee with diverse membership	2	
Impact of technology integration on the curriculum	2	2
The uses of technology for lifelong learning, special needs learners, and exceptional learners	2	2

A comprehensive facility plan for installation and periodic upgrades	2	2
A formal plan for continuous evaluation, both formal and informal	3	3
Your Score (16 possible)	➔	13

15. Rate the computers in your school computer lab and classrooms. Identify all that apply. ***(You can find out more about this question in Chapter 8.)***

	Points Available	**Points Awarded**
Most of the machines are less than 3 years old	1	
Most of the machines are CD-ROM-capable	1	1
Most of the machines are connected to printers	1	1
Most of the machines are connected to the Internet	2	2
Your Score (5 possible)	➔	4

16. Has your school developed a scope and sequence specifically addressing student technology competencies? Select one. ***(You can find out more about this question in Chapter 9.)***

	Points Available	**Points Awarded**
No scope and sequence is available	0	
A scope and sequence addressing technology is available only for graduating students (e.g., 8th graders and high school seniors)	3	
A scope and sequence addressing technology is available for selected grades (e.g., 1st, 4th, 8th, 10th, and 12th graders)	5	
A comprehensive scope and sequence addressing technology is available for all students, by grade and subject area	7	7
Your Score (7 possible)	➔	7

17. Teachers' lesson plans should include specific learning objectives when using technology-based resources. Is there evidence of learning objectives that are consistent with accepted educational psychology?? Select one. ***(You can find out more about this question in Chapter 9.)***

	Points Available	**Points Awarded**
Learning objectives are not identifiable in classroom lesson plans	0	
Learning objectives are used for technology-related lessons, but it is difficult to identify the criteria for successful student learning	1	1
Behavioural objectives are used. They include components of behaviour (actions to be performed), condition (instructional tools), and criteria (assessment standards)	7	
Cognitive objectives are used. They include components of discovery learning (student-centered growth,) constructivism (building of new meaning), and reception learning (structured learning)	7	
Humanistic objectives are used. They include components of individualization (student-tailored instruction), affective education (values training), and intrinsic learning (learning for its own sake)	7	
A combination of behavioural, cognitive, and humanistic learning objectives are used for technology-related lessons. Criteria for successful student learning are readily identified	7	
Your Score (7 possible)	➔	1

18. When using technology-based lessons in the classroom, which of the following resources do teachers personally develop and use for instruction? Identify all that apply. ***(You can find out more about this question in Chapter 10.)***

	Points Available	**Points Awarded**
Text-based materials such as handouts, study guides, and workbooks to guide the lesson	5	
Visual-based presentations, including overhead transparencies to support classroom instruction	5	5
Web-based course pages for student exploration and cooperative learning	5	5
Your Score (15 possible)	➔	10

19. Describe what typically happens when classroom teachers wish to use technology resources to present a lesson. Select one. ***(You can find out more about this question in Chapter 10.)***

	Points Available	**Points Awarded**
The computer labs or technology resources are often unavailable	0	
The technology teacher or coordinator must present the lesson	1	
Technology must be transported into the classroom for the session	3	
Computer labs or technology resources are available for scheduling without significant delays	5	5
Your Score (5 possible)	➔	5

20. How do students *in the computer classroom/laboratory describe their experience? Select one. ***(You can find out more about this question in Chapter 11.)***

	Points Available	**Points Awarded**
Play time or game time	0	
Unstructured, not sure of expected learning outcomes	1	
Applicable to what they are covering in class	5	
Appropriate for current classes and important for required/anticipated future skills	7	7
Your Score (7 possible)	➔	7

*This question restricted to students and their teachers in grades 6 and above

Comprehensive Checklist Analysis Form

(Complete the shaded areas in the table to determine your composite score in the Technology Facade.)

		Points Accumulated		Percentages Awarded	
Facade Element	*Checklist Items*	*Possible Points*	*Fill in Points Awarded*	*Fill in Percentage*	*Circle Ranking*
Use of Technology in a School or School District	Items 1 through 6	55 points	38	69.1	1 **2** 3
The Necessary Infrastructure	Items 7 through 15	104 points	34	32.7	1 2 **3**
Viable Instructional Strategy	Items 16 through 20	41 points	30	73.2	**1** 2 3
TOTALS		200	102	51	

Composite Score Form

Total Possible Points: 200	***Your Composite Score: 102***	***Your Facade Rating: C -***
175-200 points	Outstanding Technology Program	A Rating
125-175	Satisfactory Technology Program	B Rating
100-125	Modest Phase of the Technology Façade	C Rating
75-100	Moderate Phase of the Technology Façade	D Rating
<75	Severe Phase of the Technology Façade	F Rating

APPENDIX D

TECHNOLOGY FAÇADE CHECKLIST (SCHOOL B)

Technology Facade Checklist

Instructions: Complete each of the following questions by entering the most appropriate response and transferring the points to "Your Score."

THE USE OF TECHNOLOGY

School districts plan to spend more on technology in the upcoming years, the largest planned increase since technology was formally recognized in our schools over four decades ago. Are the key players in your school coming on board? Answer items 1-6 to assess the extent of technology use in your school. Total available points for this section of the Checklist is 55.

1. Are the technologies in your school used by classroom teachers, or is the computer teacher the only educator who dispenses technology-related instruction? Select one.*)*

	Points Available	Points Awarded
Computer teacher only	1	
A few teachers use technology, but not regularly	3	
A few teachers use technology routinely	5	
Technology is routinely used by many classroom teachers	7	7
Your Score (7 possible)	→	7

2. Are the computer facilities in your school…? Select one.*)*

	Points Available	Points Awarded
Locked during unsupervised periods such as recess, study halls, lunch, and before and after school	0	
Available before and / or after school	3	
Available when there are no classes scheduled	5	5
Open during recess, study halls, lunch, and before and after school.	7	
Your Score (7 possible)	→	5

3. School computers are located in our…: Select all that apply.

	Points Available	Points Awarded
Library	1	1
Classrooms	3	3
Computer lab	3	3
Your Score (7 possible)	➔	7

4. Do classroom teachers use technology for …? Rate each separately.

	Points Available				
	Never	**Seldom**	**Occasionally**	**Routinely**	**Points Awarded**
Grading	0	1	3	5	3
Lesson preparation	0	1	3	5	5
Out-of-class assignments	0	1	3	5	5
Professional development	0	1	3	5	3
Your Score (20 possible)	➔	➔	➔	➔	16

5. Is the computer teacher expected to have lesson plans with specific student learning objectives related to technology competencies? Select one.

	Points Available	Points Awarded
Computer instruction is not based on lesson plans	0	
Lesson plans are not used. There are general goals for instruction, but no specific learning objectives	1	
Lesson plans contain generic technological competencies and general learning objectives	3	3
Detailed lesson plans are used that reflect specific technological competencies expected of each student	7	
Your Score (7 possible)	➔	3

6. Does the software found on your computers reflect current classroom curriculum? Select one.*)*

	Points Available	Points Awarded
Computer software is available, but its selection was not based on teacher input and seldom reflects actual classroom content	1	
Computer software was recently purchased but is not readily available for teachers and students to use	3	
Computer software selection was based on teacher input and its use on current curriculum objectives	5	
Computer software versions are current, software selection is based on teacher input, and the software is routinely used by teachers and students	7	7
Your Score (7 possible)	➔	7

7. What is the extent of technology training received by teachers? Select all that apply.*)*

	Points Available	Points Awarded
Initial training over 6 months old	0	0
Initial training only within the last 6 months	1	
In-service training on technology at least twice a year	3	
At least two teachers per school are encouraged to enrol in formal instructional technology programs	3	
Training classes available on demand, scheduled with the technology coordinator	5	
Your Score (12 possible)	➔	0

8. Do teachers participate on the Technology Committee and its subordinate teams? Identify all that apply.

	Points Available	Points Awarded
Teachers do not participate as full voting members	0	
Teachers participate as members of the Hardware/Software Acquisition Team	3	3
Teachers participate as members of the Technology Budget Preparation Team	3	
Teachers participate as members of the Instructional Technology Curriculum Team	5	
Teachers participate as members of the Strategic Technology Planning Team	5	
Your Score (16 possible)	➔	3

9. Do parents, community leaders, alumni, and students participate on the Technology Committee and its subordinate teams? Identify all that apply.*)*

	Points Available	Points Awarded
They do not participate as voting members	0	0
They participate as members of the Hardware/Software Acquisition Team	3	
They participate as members of the Technology Budget Preparation Team	3	
They participate as members of the Instructional Technology Curriculum Team	5	
They participate as members of the Strategic Technology Planning Team	5	
Your Score (16 possible)	➔	0

10. Does your school provide direct access to the following technology professionals? Identify all that apply.

	Points Available	Points Awarded
None of these professionals are employed in our school	0	
Computer teacher (Part time/Full time)	3/7	7
Technology coordinator (Full time only)	5	
Computer technician (Part time/Full time)	1/3	
Network administrator (Full time only)	3	
Your Score (18 possible)	➔	7

11. How is technology funded in your school? Select one.*)*

	Points Available	Points Awarded
Technology is funded with year-end fallout money	1	
Technology is included in the operating budget under a miscellaneous account	3	
Technology is included in the general operating budget	5	5
Technology is its own specific, recurring line item in the annual budget	7	
Your Score (7 possible)	➔	5

12. Has your school implemented a recognition program for teachers who develop technology-based instructional materials? Select one.*)*

	Points Available	Points Awarded
There is no remuneration or recognition program to recognize excellence in instructional technology	0	0
Excellence in instructional technology is recognized in school newsletters, bulletins, and school board reports	1	
A formal awards program recognizes teachers who develop excellent instructional technology programs	5	
Teachers receive compensatory time, monetary compensation, or other specific remuneration for developing technology-based programs	7	
Your Score (7 possible)	➔	0

13. Is there a technology plan for the school? Select one.

	Points Available	Points Awarded
No technology plan exists in our school	0	
The school is working under a general district wide plan, but a local building plan does not exist	1	
The school is working on a informal strategy for technology, but a formal plan has not been prepared	3	
Yes, but it is in serious need of revision or has not been revised in the previous 2 years	5	5
Yes, and it is revised on a regularly scheduled basis at least annually	7	
Your Score (7 possible)	➔	5

14. Does your school's Technology Plan contain the following? Identify all that apply.

	Points Available	Points Awarded
No technology plan exists in our school	0	
Vision/mission statement	1	1
Demographic review of teachers, students, and community	1	
Technology-related purchasing procedures	1	
Periodic and on-call maintenance for instructional technologies used for classroom teaching	1	
Security plan regarding physical threats, human threats, and Internet threats to technology	1	
Formation and operation of a viable technology committee with diverse membership	2	
Impact of technology integration on the curriculum	2	
The uses of technology for lifelong learning, special needs learners, and exceptional learners	2	
A comprehensive facility plan for installation and periodic upgrades	2	
A formal plan for continuous evaluation, both formal and informal	3	
Your Score (16 possible)	➔	1

15. Rate the computers in your school computer lab and classrooms. Identify all that apply.

	Points Available	Points Awarded
Most of the machines are less than 3 years old	1	1
Most of the machines are CD-ROM-capable	1	1
Most of the machines are connected to printers	1	1
Most of the machines are connected to the Internet	2	2
Your Score (5 possible)	➔	5

16. Has your school developed a scope and sequence specifically addressing student technology competencies? Select one.

	Points Available	Points Awarded
No scope and sequence is available	0	
A scope and sequence addressing technology is available only for graduating students (e.g., 8th graders and high school seniors)	3	
A scope and sequence addressing technology is available for selected grades (e.g., 1st, 4th, 8th, 10th, and 12th graders)	5	
A comprehensive scope and sequence addressing technology is available for all students, by grade and subject area	7	7
Your Score (7 possible)	➔	7

17. Teachers' lesson plans should include specific learning objectives when using technology-based resources. Is there evidence of learning objectives that are consistent with accepted educational psychology?? Select one.*)*

	Points Available	Points Awarded
Learning objectives are not identifiable in classroom lesson plans	0	
Learning objectives are used for technology-related lessons, but it is difficult to identify the criteria for successful student learning	1	1
Behavioral objectives are used. They include components of behaviour (actions to be performed), condition (instructional tools), and criteria (assessment standards)	7	
Cognitive objectives are used. They include components of discovery learning (student-centered growth,) constructivism (building of new meaning), and reception learning (structured learning)	7	
Humanistic objectives are used. They include components of individualization (student-tailored instruction), affective education (values training), and intrinsic learning (learning for its own sake)	7	
A combination of behavioural, cognitive, and humanistic learning objectives are used for technology-related lessons. Criteria for successful student learning are readily identified	7	
Your Score (7 possible)	➔	1

18. When using technology-based lessons in the classroom, which of the following resources do teachers personally develop and use for instruction? Identify all that apply.*)*

	Points Available	Points Awarded
Text-based materials such as handouts, study guides, and workbooks to guide the lesson	5	
Visual-based presentations, including overhead transparencies to support classroom instruction	5	
Web-based course pages for student exploration and cooperative learning	5	5
Your Score (15 possible)	➔	5

19. Describe what typically happens when classroom teachers wish to use technology resources to present a lesson. Select one.

	Points Available	Points Awarded
The computer labs or technology resources are often unavailable	0	
The technology teacher or coordinator must present the lesson	1	
Technology must be transported into the classroom for the session	3	
Computer labs or technology resources are available for scheduling without significant delays	5	5
Your Score (5 possible)	➔	5

20. How do students *in the computer classroom/laboratory describe their experience? Select one.

	Points Available	Points Awarded
Play time or game time	0	
Unstructured, not sure of expected learning outcomes	1	
Applicable to what they are covering in class	5	
Appropriate for current classes and important for required/anticipated future skills	7	7
Your Score (7 possible)	➔	7

*This question restricted to students and their teachers in grades 6 and above

DO NOT COMPLETE THIS SECTION

Comprehensive Checklist Analysis Form

		Points Accumulated		**Percentages Awarded**	
Facade Element	*Checklist Items*	*Possible Points*	*Fill in Points Awarded*	*Fill in Percentage*	*Circle Ranking*
Use of Technology in a School or School District	Items 1 through 6	55 points	45	81.8	**1** 2 **3**
The Necessary Infrastructure	Items 7 through 15	104 points	26	25.0	1 2 **3**
Viable Instructional Strategy	Items 16 through 20	41 points	25	61.0	1 **2** 3
TOTALS		200	96	48.0	

Composite Score Form

Total Possible Points: 200	***Your Composite Score: 96***	***Your Facade Rating: D +***
175-200 points	Outstanding Technology Program	A Rating
125-175	Satisfactory Technology Program	B Rating
100-125	Modest Phase of the Technology Façade	C Rating
75-100	Moderate Phase of the Technology Façade	D Rating
<75	Severe Phase of the Technology Façade	F Rating

APPENDIX E

TECHNOLOGY FAÇADE CHECKLIST (SCHOOL C)

Technology Facade Checklist

Instructions: Complete each of the following questions by entering the most appropriate response and transferring the points to "Your Score."

THE USE OF TECHNOLOGY

School districts plan to spend more on technology in the upcoming years, the largest planned increase since technology was formally recognized in our schools over four decades ago. Are the key players in your school coming on board? Answer items 1-6 to assess the extent of technology use in your school. Total available points for this section of the Checklist is 55.

1. Are the technologies in your school used by classroom teachers, or is the computer teacher the only educator who dispenses technology-related instruction? Select one.*)*

	Points Available	**Points Awarded**
Computer teacher only	1	
A few teachers use technology, but not regularly	3	
A few teachers use technology routinely	5	5
Technology is routinely used by many classroom teachers	7	
Your Score (7 possible)	➔	5

2. Are the computer facilities in your school…? Select one*.)*

	Points Available	**Points Awarded**
Locked during unsupervised periods such as recess, study halls, lunch, and before and after school	0	
Available before and / or after school	3	3
Available when there are no classes scheduled	5	
Open during recess, study halls, lunch, and before and after school.	7	
Your Score (7 possible)	➔	3

3. School computers are located in our…: Select all that apply.

	Points Available	Points Awarded
Library	1	1
Classrooms	3	
Computer lab	3	3
Your Score (7 possible)	➔	4

4. Do classroom teachers use technology for …? Rate each separately.

	Points Available				
	Never	**Seldom**	**Occasionally**	**Routinely**	**Points Awarded**
Grading	0	1	3	5	3
Lesson preparation	0	1	3	5	5
Out-of-class assignments	0	1	3	5	5
Professional development	0	1	3	5	1
Your Score (20 possible)	➔	➔	➔	➔	14

5. Is the computer teacher expected to have lesson plans with specific student learning objectives related to technology competencies? Select one.

	Points Available	Points Awarded
Computer instruction is not based on lesson plans	0	
Lesson plans are not used. There are general goals for instruction, but no specific learning objectives	1	
Lesson plans contain generic technological competencies and general learning objectives	3	3
Detailed lesson plans are used that reflect specific technological competencies expected of each student	7	
Your Score (7 possible)	➔	3

6. Does the software found on your computers reflect current classroom curriculum? Select one.*)*

	Points Available	Points Awarded
Computer software is available, but its selection was not based on teacher input and seldom reflects actual classroom content	1	
Computer software was recently purchased but is not readily available for teachers and students to use	3	
Computer software selection was based on teacher input and its use on current curriculum objectives	5	5
Computer software versions are current, software selection is based on teacher input, and the software is routinely used by teachers and students	7	
Your Score (7 possible)	➔	5

7. What is the extent of technology training received by teachers? Select all that apply.*)*

	Points Available	Points Awarded
Initial training over 6 months old	0	
Initial training only within the last 6 months	1	
In-service training on technology at least twice a year	3	3
At least two teachers per school are encouraged to enrol in formal instructional technology programs	3	3
Training classes available on demand, scheduled with the technology coordinator	5	5
Your Score (12 possible)	➔	11

8. Do teachers participate on the Technology Committee and its subordinate teams? Identify all that apply.

	Points Available	Points Awarded
Teachers do not participate as full voting members	0	
Teachers participate as members of the Hardware/Software Acquisition Team	3	3
Teachers participate as members of the Technology Budget Preparation Team	3	3
Teachers participate as members of the Instructional Technology Curriculum Team	5	
Teachers participate as members of the Strategic Technology Planning Team	5	5
Your Score (16 possible)	➔	11

9. Do parents, community leaders, alumni, and students participate on the Technology Committee and its subordinate teams? Identify all that apply.*)*

	Points Available	Points Awarded
They do not participate as voting members	0	0
They participate as members of the Hardware/Software Acquisition Team	3	
They participate as members of the Technology Budget Preparation Team	3	
They participate as members of the Instructional Technology Curriculum Team	5	
They participate as members of the Strategic Technology Planning Team	5	
Your Score (16 possible)	➔	0

10. Does your school provide direct access to the following technology professionals? Identify all that apply.

	Points Available	Points Awarded
None of these professionals are employed in our school	0	
Computer teacher (Part time/Full time)	3/7	7
Technology coordinator (Full time only)	5	
Computer technician (Part time/Full time)	1/3	1
Network administrator (Full time only)	3	
Your Score (18 possible)	➔	8

11. How is technology funded in your school? Select one.*)*

	Points Available	Points Awarded
Technology is funded with year-end fallout money	1	
Technology is included in the operating budget under a miscellaneous account	3	
Technology is included in the general operating budget	5	
Technology is its own specific, recurring line item in the annual budget	7	7
Your Score (7 possible)	➔	7

12. Has your school implemented a recognition program for teachers who develop technology-based instructional materials? Select one.*)*

	Points Available	Points Awarded
There is no remuneration or recognition program to recognize excellence in instructional technology	0	0
Excellence in instructional technology is recognized in school newsletters, bulletins, and school board reports	1	
A formal awards program recognizes teachers who develop excellent instructional technology programs	5	
Teachers receive compensatory time, monetary compensation, or other specific remuneration for	7	

developing technology-based programs		
Your Score (7 possible)	➔	0

13. Is there a technology plan for the school? Select one.

	Points Available	Points Awarded
No technology plan exists in our school	0	
The school is working under a general district wide plan, but a local building plan does not exist	1	
The school is working on a informal strategy for technology, but a formal plan has not been prepared	3	
Yes, but it is in serious need of revision or has not been revised in the previous 2 years	5	
Yes, and it is revised on a regularly scheduled basis at least annually	7	7
Your Score (7 possible)	➔	7

14. Does your school's Technology Plan contain the following? Identify all that apply.

	Points Available	Points Awarded
No technology plan exists in our school	0	
Vision/mission statement	1	1
Demographic review of teachers, students, and community	1	
Technology-related purchasing procedures	1	
Periodic and on-call maintenance for instructional technologies used for classroom teaching	1	1
Security plan regarding physical threats, human threats, and Internet threats to technology	1	
Formation and operation of a viable technology committee with diverse membership	2	2
Impact of technology integration on the curriculum	2	
The uses of technology for lifelong learning, special needs learners, and exceptional learners	2	2
A comprehensive facility plan for installation and periodic upgrades	2	

A formal plan for continuous evaluation, both formal and informal	3	
Your Score (16 possible)	➔	6

15. Rate the computers in your school computer lab and classrooms. Identify all that apply.

	Points Available	**Points Awarded**
Most of the machines are less than 3 years old	1	
Most of the machines are CD-ROM-capable	1	
Most of the machines are connected to printers	1	1
Most of the machines are connected to the Internet	2	2
Your Score (5 possible)	➔	3

16. Has your school developed a scope and sequence specifically addressing student technology competencies? Select one.

	Points Available	**Points Awarded**
No scope and sequence is available	0	
A scope and sequence addressing technology is available only for graduating students (e.g., 8th graders and high school seniors)	3	3
A scope and sequence addressing technology is available for selected grades (e.g., 1st, 4th, 8th, 10th, and 12th graders)	5	
A comprehensive scope and sequence addressing technology is available for all students, by grade and subject area	7	
Your Score (7 possible)	➔	3

17. Teachers' lesson plans should include specific learning objectives when using technology-based resources. Is there evidence of learning objectives that are consistent with accepted educational psychology?? Select one.)

	Points Available	Points Awarded
Learning objectives are not identifiable in classroom lesson plans	0	
Learning objectives are used for technology-related lessons, but it is difficult to identify the criteria for successful student learning	1	
Behavioral objectives are used. They include components of behaviour (actions to be performed), condition (instructional tools), and criteria (assessment standards)	7	7
Cognitive objectives are used. They include components of discovery learning (student-centered growth,) constructivism (building of new meaning), and reception learning (structured learning)	7	
Humanistic objectives are used. They include components of individualization (student-tailored instruction), affective education (values training), and intrinsic learning (learning for its own sake)	7	
A combination of behavioural, cognitive, and humanistic learning objectives are used for technology-related lessons. Criteria for successful student learning are readily identified	7	
Your Score (7 possible)	➔	7

This applies mostly to grades 5, 6, and 7

18. When using technology-based lessons in the classroom, which of the following resources do teachers personally develop and use for instruction? Identify all that apply.)

	Points Available	Points Awarded
Text-based materials such as handouts, study guides, and workbooks to guide the lesson	5	5
Visual-based presentations, including overhead transparencies to support classroom instruction	5	5
Web-based course pages for student exploration and cooperative learning	5	
Your Score (15 possible)	➔	10

NB. We do not have technology in the 'classroom'. Students and teachers must come to the lab.

19. Describe what typically happens when classroom teachers wish to use technology resources to present a lesson. Select one.

	Points Available	Points Awarded
The computer labs or technology resources are often unavailable	0	
The technology teacher or coordinator must present the lesson	1	
Technology must be transported into the classroom for the session	3	
Computer labs or technology resources are available for scheduling without significant delays	5	5
Your Score (5 possible)	➔	5

20. How do students *in the computer classroom/laboratory describe their experience? Select one.

	Points Available	Points Awarded
Play time or game time	0	
Unstructured, not sure of expected learning outcomes	1	
Applicable to what they are covering in class	5	5
Appropriate for current classes and important for required/anticipated future skills	7	
Your Score (7 possible)	➔	5

*This question restricted to students and their teachers in grades 6 and above

DO NOT COMPLETE THIS SECTION

Comprehensive Checklist Analysis Form

		Points Accumulated		**Percentages Awarded**	
Facade Element	*Checklist Items*	*Possible Points*	*Fill in Points Awarded*	*Fill in Percentage*	*Circle Ranking*
Use of Technology in a School or School District	Items 1 through 6	55 points	34	61.8	1 **2** 3
The Necessary Infrastructure	Items 7 through 15	104 points	53	51.0	1 2 **3**
Viable Instructional Strategy	Items 16 through 20	41 points	30	73.2	**1** 2 3
TOTALS		200	117	58.5	

Composite Score Form

Total Possible Points: 200	***Your Composite Score: 117***	***Your Facade Rating: C+***
175-200 points	Outstanding Technology Program	A Rating
125-175	Satisfactory Technology Program	B Rating
100-125	Modest Phase of the Technology Façade	C Rating
75-100	Moderate Phase of the Technology Façade	D Rating
<75	Severe Phase of the Technology Façade	F Rating

APPENDIX F

SAMPLE PROFESSIONAL DEVELOPMENT ACTION PLAN

ACTION PLAN WORKSHEET

Objective or Goal for Integration of Technology Project:

To evaluate the time and money spent on using/learning technology is worth it

1. Understand how to use PowerPoint as a program and how to use it effectively in a primary classroom
2. Understand how to use Kidpix as a program and how to use it effectively

Strategies	Staff Development	Needed Resources	Person(s) Responsible	Target Dates Start Finish	Evaluators and Indicators of Success	Cost (Monies or TOC days)
Attend workshop on how to use PP	Workshop	Andrew Lab	Andrew	Oct 23 Oct 23	Presentation to class.	
Attend workshop on how to use Kidpix	Workshop	Support when needed. Work with other staff members involved in program	Andrew	Oct 30 Oct 30	Group discussion in effectiveness in terms of time spent/money spent-Did it improve learning/improve motivation. Was it better than pen and pencil?	NO cost time
Develop a PowerPoint presentation as an opening for spare unit	Prep time	Computer	Me	Oct 26 Jan 5		
Design a Kidpix task for varied grade classes (integration-IRP, writing?)	Prep time		Me		Student add disk of project to portfolio.	
Keep a Journal	Prep time		Me	Oct 26 Jan 5		

APPENDIX G

SAMPLE SCHEDULE OF INTERVIEW QUESTIONS

INTERVIEW SCHEDULE FOR TEACHER A – 4

1. In your journal, you indicate that you "spent one frustrating year being the computer lab administrator for" School A. Expand on that sentiment.
2. You also indicate that you felt that your student teachers have influenced your beliefs about technology with Grade One students. Tell me more about that influence.
3. In your opinion, why has learning about technology caused you to no longer feel so strongly about the money spent on computers?
4. Is the time and money invested in technology worth it to you? Why or why not?
5. Have you found other teachers that are questioning the use of computers? If so, describe a sample conversation.
6. Without naming names, describe one or two colleagues who have influenced—positively or negatively—your beliefs about technology.
7. In terms of technology, are you a take-action sort of person or someone who tries different things after hearing about them from others? Expand on the answer.
8. Describe how your role as a teacher has changed in the last five years
    a. In general
    b. In relation to technology
9. Do you find that once you learn one technology (e.g., FrontPage), you are able to take the necessary action to learn another program (e.g., PowerPoint) more efficiently? Explain.
10. Is it easier for you to change the way you act and react to technology or to abandon the technology? Explain.

11. On your questionnaire, you indicated that you did experience a change—what the research calls a "perspective transformation"—what factors do you believe prompted you in experiencing that change?
12. On the questionnaire, you checked nine of the ten boxes. What I would like to do is read the statement and have you expand on each answer.
    a. I had an experience that caused me to question the way I usually act.
    b. I had an experience that caused me to question my ideas about social roles.
    c. As I questioned my ideas, I realized I no longer agreed with my previous beliefs or role expectations.
    d. I thought about acting in a different way from my usual beliefs and roles.
    e. I tried out new roles in teaching so that I would become more comfortable or confident in them.
    f. I tried to figure out a way to adopt these new ways of acting.
    g. I gathered the information I needed to adopt these new ways of acting.
    h. I began to think about the reactions and feedback from my new behaviour from others.
    i. I took action and adopted these new ways of acting.
13. Are you frustrated with technology, the infrastructure for technology or both?
14. Describe how supportive you have found the present administration versus your previous administrations in regards to technology.
15. The theoretical framework I am using in this study is "Transformative Learning" which is based on the three key principles of adult learning: (1)

autonomy; (2) empowerment; and (3) collaboration. In your opinion, is this framework viable for teachers' development in technology?

APPENDIX H

SAMPLE TRANSCRIBED INTERVIEW

INTERVIEW SCHEDULE FOR A - 2

In your journal, you indicate that you found the tutorial useful (on webpage construction) but needed further human support (from me) via email.

a. How important is the "human" aspect of learning technology?

So in my experience, it was very important. I don't think that without the opportunity to have talked to you over the telephone and to have had that immediate response with the email, I think I would have gotten stumped and I would have walked away. But because I was to get the questions to those answers so quickly, I was able to carry on and continue. So, I think it was very, very important. [*Query: And have you found that the human aspect has always been important since then?*]. Yes. But I do think that the more I learn, and the more competent I become, maybe a little bit less reliant on having someone there. I think that mostly when I first learning, I needed those questions answered right away. I think I am better now at solving, investigating, taking things on, and giving them a try on my own now. … Yes. I just think that is an innate sense. I just have that feeling of.

b. What sort of action have you been able to take based on that answer?

Answered above. [Added] **There were times we, as a staff, revisited the idea of creating web pages but I predict many of the staff felt much like I did during my first experiences. Excited at its potential but then what? We all need to ask where we go next.**

The tenor of your journal entries appears to show how your emotions go from frustration to elation as you work with technology.

Is that true?

Yeah. I'm smiling in the fact that I'd be surprised that everybody didn't have that same path.

If so, give me a concrete example of that emotional roller coaster.

When I was thinking of that one, I had this experience where I had gotten very far in the webpage and I was at home. And I had spent hours creating it. and I went to do the upload and there was some kind of a glitch and I remember that Fall of wanting to put my foot through it. You know, I just couldn't believe that I had spent all these hours and it just wasn't working. And I think that, at that point, if I had some communication with you, some with A – 1, and it still didn't work. And then it did work. And then it went from VERY frustrated to "OH YEAH!" And that was the big one because I think that was the time it was up and running. You know, there was my webpage and I was able to come in and use it that week.

You've begun using the computer for much of your work—inside and outside of the school—why?

I think, for me, it's a bit about time management. I find it to be a much more effective use of my time. I must be truthful. I like the presentation; I like things to look good. And I am not a handwritten-happy person so, you know, it solves that for me . I can a little bit of perfectionism in there with very little effort. And yes, it's just time management. It helps me get done what I need to get done. And it looks good, to boot. … When I was doing my teacher training, I received my first computer near the end of it and it was a DOS and WordPerfect. And even then it was exciting to type out stuff. No, there was no training there. It was my first year of teaching that they brought my

first lab in and, yeah, occasionally I'll come across some archaic examples of what we did back then.

Have you found other teachers that are questioning the use of computers? If so, describe a sample conversation.

Yes. That's general staffroom talk. … "I couldn't be bothered to go to the lab today. I just couldn't even take the chance today that they weren't going to be working." Or another conversation would be "You know, we got all this work done and we went to print it off and the printer was jammed. What waste of time."

The traditional social expectation for a teacher appears to be one who uses, integrates, or teaches technology—are you comfortable with that role?

Yes. I think so. I do think that's part of my role. I do think that they're part of our presence and our future. And I think that I need to set that. [*Query: Why when the Ministry of Education doesn't have Integrated Resource Package technology standards?*]. Because, as a staff, we've talked about how we need a scope and sequence. We need a common language throughout the grades. So I think that, in a sense, we are asking for it; however, we are trying to balance that by already trying to meet all these other IRPs. So do we really want something else imposed upon us? Yet there's talk there anyway. That it is happening and that we are trying to sort of strive for that.

Without naming names, describe one or two colleagues who have influenced—positively or negatively—your beliefs about technology.

Absolutely. I mean, through my journals, A – 1 was a huge part of me creating that webpage. And it was that fact that we both had the same goal; we were both similar in our styles in pursuing and getting it. And being good

time managers. Not sitting there and having a little gib-gab but let's get it done and let's make this work. So I find her a very easy person to work with. On technology or anything else because we are similar in that way. And I just thing that having that. You know, we wanted to be able to use you only when we couldn't get it ourselves so we would try and work it out between the two of us first. And then we would take it to another level which would be emailing you so I think that was a really important part of me getting where I got to. On the negative side of it, when it was imposed upon me. I didn't have near the success although it's not that it was a control issue for me because it wasn't. I just didn't have the same ownership in it. And when it was someone else's project, you know, I did what I was supposed to. I jumped through the hoops but I didn't really own it. And I think that even though I didn't really own it, I sort of still got a chance to see the potential. And that's sort of what made me want to own it but yeah. I'm not even sure that that was a negative experience because something positive came out of it. But the actual use of what I created during that project, I don't even know where it is. Nor do I care. … Yeah, functionality and purpose (mean ownership to me). I don't want to do something that is not a good use of my time. [*Query: Projects with A - 3?*] No. I think that, through very limited conversation, I just sense that she's not on the same motivation or interest level that I am. For me, I think I go home in the evenings and I almost think of it as a hobby. It's just an extra thing that I enjoy whereas for her, and I may be wrong, I would sense that that would be sort of an onerous activity for her—something I had to do. However, I still bring my enthusiasm to the table and say, "Let's do this together." But knowing that I fully intend to take the load of that project. So

one of the things we'd hope to do is put a Powerpoint together for the parents for appreciation—Mother's Day, Father's Day thing. I had every intention of doing the work and yet sharing in that it's something "we've" done. Because she is my teaching partner, she picks up the load in other areas so for me to pick up the tech load is simple and easy and something I enjoy anyway. And she picks up the load in other ways. … But I think, in terms of technology, I tend to be the one that does that part. Initially, we had the luxury of time to chat with other teachers because [the principal] hired substitute teachers. Now, for example, A – 3 and I make the time to discuss how we can mesh projects for our respective students, even though we do it in our own time.

To what degree did your student teacher influence your views on technology?

I think that it sort of strengthened the fact that yeah they are coming out teaching it. And I want to stay current and I don't want to date myself and say "Well, I'm a different generation." So it gives me that little bit of push to stay on top of it. Anything they can do, I can do, too.

Do you find that once you learn one technology (e.g., FrontPage), you are able to take the necessary action to learn another program (e.g., Powerpoint) more efficiently? Explain.

Yes. I think so. I think the more you immerse yourself in anything. One of the notes I took last night, it's the same as with our literacy. You know, it all starts to sort of overlap and it all becomes connected and that's what we want for the kids. We want to see those connections so I think for FrontPage and Powerpoint—obviously they're both Microsoft—-they have that connection anyway. You can see how they all fit into one another. They're a lot more common or a lot less unfamiliar. They're not so new. [*Query: Why would*

***some teachers not make that connection?*] My guess would be—I don't know the answer—but I would guess just not enough exposure. Just like with kids, if they're not making the connection, we haven't let them play enough. Maybe they haven't had enough opportunities to play in those programs.**

Is it easier for you to change the way you act and react to technology or to abandon the technology? Explain.

It's easier to abandon it but not in my nature. I would rather act and react. And I would rather get it. But it would be easier to stomp away and say "forget it." But not in my nature. I think my nature is more to stick with it. [*Query: Is that because you are tenacious?*] I think so. I think that's just who I am. But I do think that the more I learn, and the more competent I become, maybe a little bit less reliant on having someone there. I think that mostly when I was first learning, I needed those questions answered right away. I think I am better now at solving, investigating, taking things on, and giving them a try on my own now

Is the time and money invested in technology worth it to you? Why or why not?

That's a hard question because if you give that much money to technology, it's going to be taken away from somewhere else. So I wouldn't be fair in saying that I would love to only be passionate about technology because I am passionate about a whole host of other things as well. But, without money going into it, I wouldn't have been able to do what I've done. And I'm pretty proud of what I've done and I think what I've done is very useful. So I would have to say, "yes, it is worth it." Because I am at where I am at because I had the release time and the financial support to get there. And I had, even

though our technology can be a little bit unreliable, I mean, it was reliable enough to teach me what I needed to do. Whether or not, it should deserve that kind of budgetary status, I don't know. One-fifth of all the budget. That's a lot and yet technology is a very expensive thing. What I would love to have faster-running computers? You bet. And yet, I know, in five years, they would be outdated again. And that's the frustration of it. But I don't any other way of teaching technology without actually having computers. [*Query: Do you think that there should be a dedicated budget for technology?*] I think that would be fair. I do.

On your questionnaire, you indicated that you did experience a change—what the research calls a "perspective transformation"—what factors do you believe promoted your experiencing that change?

This question made me smile because I took it that somebody else had been prevented from doing that. So I read into that. Somebody else didn't, eh? … Okay. I think that I had the financial support to have the release time to actually practise it here at work. I think that if I had been at home, I would have been too isolated and I think that my chances would have been too … more limited. I think that the fact that I could do it here at school with a colleague, with the phone and email resources right there, with your tutorial that came through on paper, that was huge because we followed that step by step. I think that just the success that it all came true. That motivated me to keep going and learn more. Had my first big project not taken off, I don't know if I would have been as open and available to trying all the others. But the success of that certainly kept me going. However, as I've already said, it would have been easier for me to abandon that. I really had to stick with it

and get to it. And it's not easy to always ask for help. And I felt that, at times, I was a pain because I had to keep asking. Had you not been available, I don't know who I would have been able to go to. This district has gotten rid of our support people that way. I don't feel there was anybody on staff I could have gone to—other than someone who was at the same place or not even there yet. So, I think that will be hard for other people if they can't find sort of a mentor. That doesn't mind the step-by-step walking them through it. That's … I was very lucky. [*Query: Pioneering spirit helped?*] Sure. That would be part of it, too. But, a new staff member coming on now … but I would be there to help them. But, yeah, I don't know if it is always so easy for someone to get the support they need.

Three years ago, you appeared to be limited in the technology you were using—what has changed that you now have created your own website, edited movies, utilised Kidpix, and learned Powerpoint?

> **I started by opening PowerPoint and selecting a new page. I picked a format and gave it a title, "Let's Learn About the Coldest Places on Earth". I was able to change the background colour, add clip art and change the font. It looked great. Then I tried to think about [what] I wanted the presentation to accomplish or how I would use it. But then what???... so I decided to create something I could use to introduce the unit based on what I found at the websites [that you gave us in the workshops]. … I also considered the good and bad of the WebQuests. Through conversation I found that a colleague was in a similar place and she too wanted to create [a webpage] that was useable and real. With support of one another, [the researcher's] leadership, and the money from**

the NIS project (which gave us release time) we were able to create our own pages. Other colleagues were impressed and supportive, but not yet ready to undertake the same learning challenge. I have invited other teachers to use what I have created with their own classes. Yes. Probably the NIS grant. Such an awareness thing that came to our school. So much discussion; starting to investigate. Probably what opened it up. I don't know exactly when the WWW really took over but, for me, it took over at that point. All of a sudden, it was this new venue that I hadn't really tapped into. And I was, like, so in awe by what I could find one there; it was just a kid in a candy store. I think that might have been it. I think that might have been my opening to the Internet and really seeing the value in that. And then using all of these tools to take advantage of that. [*Query: Was it a conscious decision or a more gradual and global change?*] No. I think it was the first. I think it was one at a time. I think it was, personally, "I need the Internet. I need Shaw cable; I can't possibly use a phone line. Now, oh my gosh. Now I need a webpage. Okay, now I want to learn how to make a webpage." Then I learned how to make a movie. Then I learned. I am more global now but, in the beginning, it was one thing at a time.

Are you frustrated with technology, the infrastructure for technology or both? **Sure. I get frustrated with the hardware here as well. I mean, I see what I can do at home. The speed. I like speed. And I wish that I could share that with these kids here. Where I can share with my own kids at home in a sort of homeschooling situation; I can't share with the kids here. Yet I wish I could. An example of that would be a really amazing movie about penguins that I**

watched at home. And it was just fantastic; the music; the visuals; the whole bit. And here, you know, it was just still loading and it just lost its impact. So sure, I get frustrated with it but, you know, there's lots of other things in the system that frustrate me as well. Take it with a grain of salt and do what you can. …I have 60 minutes in the lab a week but, I'll be honest, I usually only use 30.

If all the hardware and software worked, would you use technology more in a lab setting or a classroom setting? Why?

For my teaching style, I think I would introduce in the lab and we would save in the lab and we would follow up in the classroom. I can see me doing a whole class lessons, do the presentation, maybe begin in it, and then I would see it happening in the classroom. I could have a parent support me on that. I think that would be ideal for me. To have really skookum computers in the classroom. Just two of them on the go all the time. Because I think that kids they need to be able to come and go; they need to take a break from what they're doing. When they're inspired, they need to have that chance to go and do it. I'd love to see good classroom computers. If I had to have the choice, I would take the classroom over lab because I could still do my classroom teaching as they sat around the classroom computer. And then I'd send them off to it. (*If I had a data projector and laptop*), I'd use it all the time. Also, I really believe that I have changed now from what I used to believe my role as a teacher was. I think I get more of what I really want and need to best meet the learning outcomes for the students in my class. I also believe that technology has made me a better communicator to the parents of the children in my class. I find myself sending home more correspondence due to the ease,

quickness and quality of the documents I can produce in a word processing program. I have also been experimenting with an online newsletter and calendar of events on my web page. And … before you came long, I just came to the realization that I was wasting time on [technology]… so I had to change…. I think the most prominent change in terms of my teaching has been in the area of preparation. I use word processing continually to help make my classroom an organized environment rich in literacy and numeracy charts, poems and ideas. In terms of preparing my lessons to teach each day, I think technology has enabled and inspired me to produce my own "teacher packets" of activities to use with the students.

The theoretical framework I am using in this study is "Transformative Learning" which is based on the three key principles of adult learning: (1) autonomy; (2) empowerment; and (3) collaboration. In your opinion, is this framework viable for teachers' development in technology?

So owning it and giving me the opportunity and then giving me a chance to talk about? I would say, "yes." That is definitely the model that worked for me. Owning it, giving me support and time to do it, and then giving me a chance to talk about it. [*Query: Would it work for other teachers?*] No. I think that would work. I think that whenever anybody owns it, then they're supported, I think it's perfect. I had been to so many workshops where the presenter took us through the technology and it was great. The problem came when I went to do the work and then it was gone. Poof! … Now, from what you've done with us, I know that we need to have someone who knows their stuff but also that person has to give us a challenge. If I know that someone wants me to do it and gives me the confidence, I will do it.

APPENDIX I

SAMPLE FIELD NOTES

October 30th, 2003:

It appears that School A has no problem collaborating and finding time to meet. Schools B and C don't seem to be particularly collaborative but the individuals do. For example, B -1, B – 2, and B – 3 do get together (with another School B teacher) "about every two weeks" (B – 1 comment) to discuss educational technology. Skills, issues, strategies and the like. As well, C – 1, C – 2, and C – 3 are trying to meet "when they could" (C – 1 comment) but don't get a lot of support from the Head of School

January 19th, 2004:

C – 2 comments on being inspired by the feedback from her class. Note that she was confident in some aspects of technology but really needed feedback from others. She said: "I experimented with some software and made a neat picture-thing. It wasn't anything fancy so I didn't really want to show other people. A month ago, I showed it to my class and they clapped and were really pleased. It blew me away that they would be so enthused. It spurred me on."

APPENDIX J

SAMPLE EMAIL EXCHANGE

<u>A – 1 email message</u>:

Hi Andrew,

I love technology...my family keeps me away from new gadgets. However, I am still working on how I feel about their use in schools.

I have however changed my mind about my Powerpoint project. Everything changed when I worked with [my student teacher] helping students do their own Powerpoint presentations. I still haven't done my own Powerpoint but have decided to one as an introduction to a unit on "Pioneers" instead of " Space". There are so many good space sites for students to access on the Internet plus they all love the topic anyways. It seems silly to spend time creating an introduction that was going to be used to motivate them. However, very few sites touch on the topic of "pioneers" especially at their level. Also, they haven't a clue who pioneers are. I thought it would be interesting to use Powerpoint to introduce the topic and then have an ending where they get involved. I have pictures I took of pioneer objects/tools/etc. at the Provincial Museum. I always intended to put together a "Critical Challenge" using them but never find the time. I thought it might be interesting to use them in a Powerpoint and have students guess what they are etc. What do you think?

Thanks,
A – 1

<u>My response</u>:

A – 1:

Excellent idea to switch to the Pioneer idea. I have a great book on Pioneers if you need a printer source. If you go to the Bernie Dodge website/portal, there are a few examples of WebQuests on the subject of pioneers. They will give you some ideas on what information there is out there. Also, look at the tutorial I did on making Jeopardy games with PowerPoint and the one on making presentations with PowerPoint.

Thanks for the notice on the change.

Andrew

APPENDIX K

SAMPLE DIAGRAM

B – 2's Planning Diagram