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RELATIONSHIPS BETWEEN SELECTED ELEMENTARY TEACHERS' BELIEFS AND EDUCATIONAL TECHNOLOGY USE

by

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RELATIONSHIPS BETWEEN SELECTED ELEMENTARY TEACHERS' BELIEFS AND EDUCATIONAL TECHNOLOGY USE

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Dedication

—For the Figg men in my life:

Harold, my dear husband, and my two sons, Matthew and Aaron,

for earning their Ph.T's (Putting Her Through!)

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- And, my husband and two sons, whose unfaltering support, love, and faith in my ability to achieve helped me realize that my finest accomplishment is having them in my life.

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Situated in the constructivist research paradigm, the purpose of this study was to investigate how selected teachers' beliefs and their uses of technology within their teaching practices are related, customizing training according to teachers' beliefs about and practices of teaching. The study design consisted of three stages: establishing participants' personal beliefs about teaching and learning; developing a personalized plan of professional development that supported the participant in achieving self-selected technology implementation goals, and exploring the relationships between participants' beliefs and technology use in instruction.

Data generated during the stages were analyzed using a constant comparison method from which the following series of common threads, or themes, emerged.

First, teachers' preferred educational uses of computer-based technologies may be related to their notions of the relative importance of students' interest and preferences vs. teachers' perceptions of student learning needs when planning for instruction. Secondly, beliefs expressed by participants about learning and teaching are related to teachers' use of technology in four ways: why technological tools are perceived as valuable to instructional activities; how technologies are incorporated into activity structures; how technologies are used to support curriculum; and why technologies do not support all instructional activities. Third, these teachers expressed three reasons why they chose to acquire and integrate specific technology applications into their instruction: access to modeling in classrooms, their present curricular needs, and personal interest in using applications. Finally, participants perceived two deficiencies—lack of time to plan, create, and implement technologically-enhanced activities and lack of advanced skill training—that were serving as barriers impeding integration.

Lessons to be learned from these findings remain the reader's responsibility within the constructivist paradigm, but certain implications which remain the opinion of the researcher were suggested for consideration in technology-related professional development for teachers. These implications include the need for training that focuses on use of technology as a real-world tool while emphasizing student interests, development of a continuum of "learning to

integrate" that moves teachers from using technology as a tool to "integrators" of technology, and finding innovative ways to structure training that address time issues and advanced training needs of teachers.

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CHAPTER 1

A Close Encounter of the Educational Kind

"I'm simply going to throw this confounded mechanical thing into the creek," my husband exclaimed as he walked through the door. Just the thought of tossing away the new $10,000 piece of computing wizardry that we had just installed really got my attention! Having spent many years in the classroom, I recognized the signs that accompany the frustration that occurs during the learning process when support and successful experiences are not provided. What my husband really needed, (and quickly, I might add), was a successful experience that would demonstrate to him that the computer could become a very valuable tool in his accounting practice. Together, we investigated a variety of software that was compatible with our new IBM PC (circa 1980). Fortunately, before the computer became airborne, we came across a wonderful billing tool that allowed him to capture his chargeable time, create billing statements, and keep a database of all billing records simply from inputting information at the time the charge occurred. His experiences using this tool were easy, successful, and allowed him to streamline a component of his business that had been time-consuming and cumbersome so that his time was used more efficiently.

Understanding that computing tools must provide the user with a different and more effective way of accomplishing work was not the only lesson demonstrated by this little experience! I witnessed the truly motivational power that computers are capable of bringing to the learning situation. There was one small feature within this program that grabbed my husband's interest and turned his fears about using technology into dust. The program had a small box that continuously displayed the chargeable time in dollars as my husband worked, clicking off the dollars as the chargeable time mounted up. My husband could actually see himself earning money as he worked. Not only did this encourage more consistent work habits, but his reluctance to use the computer quickly disappeared as he learned to work every feature within this program. Soon, he was off working on other programs with the same enthusiasm, convinced that other software could impact the efficiency of his work.

The educational moral of this story is simple: the learning experience becomes more powerful when tools and resources that tap into the interests of the student are used. Effective teaching incorporates those instructional tools and resources that provide the student with meaningful and engaging learning. Speaking as educators, this simply means that we seek out those teaching tools that will motivate student learning while accomplishing the instructional goals and objectives we design into the educational experience. The motivational power behind instruction designed to incorporate computer-based technologies is often

given as one of main reasons teachers want to learn to use these new technologies within their own instructional designs and daily practices.

Hence, one would expect the issues surrounding the integration of computer-based technologies into the daily instructional practices of teachers to be those that address how each teacher could best implement the tools within the instructional design, either by managing the tools in the classroom setting, integrating the tools into their individual teaching styles, or choosing the appropriate application for the learning goal. Sadly, this is not the case (Lowther, Bassoppo-Moyo, & Morrison, 1998). The findings regarding the integration of technology into daily instructional practices being discussed within the literature reviewed for this study focus upon issues important to external sectors that influence our educational system. First, from the educational reformers, teachers are bombarded with the notion that they must incorporate constructivist teaching methods, which emphasize "student-centered learning in an open-ended environment" (Morrison, Lowther, & DeMeulle, 1999, p. 5). Computer-based technology, which lends itself easily to supporting the constructivist teaching methods of problem-solving, collaborative learning, and situated cognition, could be just the ticket to accomplish this change (Collins, 1991; Mehlinger, 1996; Morrison et al., 1999; Murphy, 1995). Secondly, the business world is ready with funding for technology programs and suggestions for the most efficient way to produce a work force that is competent to compete in the global economy; private

sector influence promotes the learning of specific technical skills needed for the workplace, rather than learning that promotes the development of skills not necessarily relevant to the workplace, but related to student interest and other learning contexts (Morrison et al., 1999). And, finally, the push from legislators, administrators, and parents to justify the expense of computer tools by proving their effectiveness in the learning process presents a different set of values and goals that teachers must satisfy (Education Week, 1998). The common focus among all the issues seems to be that the student must come away from their educational experience technologically competent to function in a high-tech economy.

Therefore, the training of teachers who are to produce these students has become paramount. A great deal of money, time, and support has been poured into technology training for teachers (Education Week, 1998; Education Week, 1999; U.S. Department of Education, 1999), with the goal of getting the technology into the hands and educational experiences of the students as quickly as possible. Historically, computer-related training has focused upon the technical aspects of acquiring personal skills with software applications (Evans-Andris, 1995b; Northrup & Little, 1996). Teachers were trained to use an application, such as PowerPoint or HyperStudio, rather than shown how this application might effectively be used with students. The debate regarding the effectiveness of this type of technology-related professional development has finally shifted the focus

of training to the use of these applications within the classroom structure (Apple Classrooms of Tomorrow (ACOT), 1995a; Dwyer, 1994; Evans-Andris, 1995b; Lowther et al., 1998; Morrison et al., 1999), in order to answer the questions, "How does a teacher use these tools as part of the instructional process?" and "How does a teacher manage a classroom of children and provide computer experiences that are instructionally valid and promote learning?" These are the very questions that some teachers need answered before they are able to construct learning experiences for their students that utilize computer-based activities to promote learning.

The research community studying this phenomenon (Apple Classrooms of Tomorrow (ACOT), 1995a; Apple Classrooms of Tomorrow (ACOT), 1995b; Becker, 1998; Collins, 1991; Dexter, Anderson, & Becker, 1998) suggests that the individual teacher, the key to all instruction, must undergo a change process in which s/he gradually adopts more progressive teaching methods as a means of successfully implementing the technology tools, a "first step in their evolutionary progress toward a constructivist orientation to teaching" (Dexter et al., 1998, p. 2). Although technology is only one of the many means to implementing a constructivist orientation to education, researchers and reformers during the last decade expected technology to serve as a catalyst for change in teaching from traditional to constructivist methods (Collins, 1991; Dwyer, 1994; Mehlinger, 1996; Sheingold & Hadley, 1990). Yet, Roger's (1995) research regarding the

change process of individuals indicates that only 13-15% of the population eagerly adopts innovations; the rest are more resistant to change and may require long periods of exposure to the innovation before adoption occurs. Long periods of exposure to computer-based technologies are also cited as a critical factor in teachers integrating technology into their classroom practice. Teachers need time to become familiar with the technology, and time to plan and work with the technology in teaching (Becker, 1994; Becker, 1998; Dwyer, Ringstaff, & Sandholtz, 1990b; Evans-Andris, 1995b; Hadley & Sheingold, 1993).

So, how do we design training that will address teachers' reluctance to change and still allow them to begin implementing computer-based technology within their current teaching practices, recognizing that as the teachers become more familiar with the technology and have time to work and plan with the technology in the classroom, they may possibly change their teaching styles? Pajares (1992), in his review of educational research regarding beliefs' influence upon the educational practice of teachers, found that there is a "strong relationship between teachers' educational beliefs and their planning, instructional decisions, and classroom practices" (p. 326). Nespor (1987) and Doyle & Ponder (1977-78) further suggest that individual teachers' beliefs are personal, based upon their experiences of what worked for them in the classroom setting, and that these beliefs prove to be more influential in promoting change than the individual's knowledge about learning theory or teaching. In other words, teachers will adopt

an innovation, such as computer-based technology, into their teaching practices when it supports what they believe is the best way to teach and learn (Dexter et al., 1998; Rogers, 1995).

Thus, if teachers are reluctant to change, and accept only the changes that support good professional practice as defined by the individual teacher (Doyle & Ponder, 1977-78), then training that builds upon individual belief systems and matches the technological tools to the methods the teacher perceives as most effective might be more relevant, useable, and productive.

Therefore, the question becomes: what if teachers were made aware of their own deeply-held personal beliefs about teaching and learning, and after reflecting upon the most appropriate and comfortable methods of instruction that best fit their teaching personae, were shown how they could best use an innovation, such as computer-based technologies, within the framework of their existing instructional practices? Would matching the technologies to the current teaching practices of individuals produce successful, motivational learning experiences for the teachers?

Exploring the beliefs that teachers hold regarding their roles in the instructional milieu of their classrooms and how that influences their ability to provide their students with opportunities to use computer applications as part of everyday learning and teaching was the focus of this inquiry. The investigation endeavored to provide in-depth insights into the perceptions of seven teachers as

they struggled to bring technology into their daily teaching practices and instructional designs. Perhaps these insights will be valuable to those of us who provide educational training and instruction for inservice and preservice teachers.

CHAPTER 2

Introduction

While reviewing the findings of a pilot study I recently conducted with a group of preservice teachers entering their beginning field experiences (Figg, 1999b), I was struck by the deep concerns that each of these student teachers expressed regarding integration of technology-based activities into their instructional practices. Their concerns centered on misgivings regarding their abilities to integrate technology within their teaching practices so that computer applications were used as part of their students' everyday learning activities. Although these student teachers had completed an intensive computer competency class, demonstrations that modeled successful integration of technology within a classroom setting appeared to be insufficient within their technology training, field experiences, or teaching preparatory experiences to allow the student teachers to develop usable integration techniques. These novice educators had not developed a comfort level with using technology with their students and felt unsure of a viable method of infusing technology use into their classrooms.

Research indicates that these student teachers are not alone. Many teachers believe that although they possess more technology-related skills and personally

use technology more than in the past, they are still unprepared to effectively integrate instructional technology (Education Week, 1999). In another recent survey, the National Center for Education Statistics (1999) found that despite more hardware and software in the schools, teachers felt inadequate to effectively use them in their daily instruction; and therefore, little use is being made of the increased access to technology. In fact, many classroom teachers rely upon their student teachers, who are recently trained in the newest technologies, to provide the much-needed support and hands-on training lacking in professional inservice (Northrup & Little, 1996).

Moreover, mere acquisition of personal technical skills does not translate into "technology integration." By defining integration as the ability of the teacher to appropriately use technology-based activities as a part of their students' everyday learning activities, as well as a part of the teacher's everyday teaching activities, successful integration of technology into the classroom becomes "characterized by an individual who can think conceptually about microcomputer applications in relationship to learning (Lowther et al., 1998, p. 98). Hadley and Sheingold (1993) define integration as requiring that "teachers readily and flexibly incorporate technologies into their everyday teaching practice in relation to the subject matter they teach" (p. 265). These technologies, for the purposes of this study, will be defined as hardware and software such as computers,

CD-ROMs, videodiscs, graphing calculators, digital cameras, and scanners, rather than the older technologies examples (e.g., videotape, books, and blackboards) which are already seamlessly integrated within instructional practices of classroom teachers.

The problem, therefore, becomes not so much a matter of teacher training or acquisition of computer skills, but of application of skills within the context of the classroom. Teachers must be able to use the computer application skills they have acquired to design, facilitate, and manage a learning environment in which the computer functions as an "instructional partner" in the process of constructing knowledge (McDaniel, McInerney, & Armstrong, 1994). Lowther, et al. (1998) describe this process as one in which the teacher becomes "technologically competent" rather than merely computer literate. The "technologically competent" teacher ceases to view the computer as a delivery system (much as the "computer literate" teacher would) and begins to view "the computer as a tool to solve problems, to provide rich data sets, to compress or expand time, and to simulate real-world events" (p. 98).

But how do teachers learn to apply their skills so that computer applications are used as part of their students' everyday learning activities, as well as a part of everyday teaching activities? What promotes their learning process? What impedes their learning process? We know from studies such as

Eisenhart, Cuthbert, Shrum, & Harding (1988) that teachers embrace and incorporate innovations that they perceive to be relevant and beneficial to their teaching. Therefore, the act of becoming "technologically competent" must include teachers' perceptions as to what they feel assists them with integrating technology. In addition, there are special issues that must be addressed within learning situations in which technology is incorporated (Morrison & Collins, 1995; Sandholtz, Ringstaff, & Dwyer, 1990). These issues, such as creating appropriate lesson designs, providing for management of a technology-enriched classroom, providing the student training necessary to engage in technology-enhanced learning activities, and determining roles for the teacher during instruction, must be understood by teachers in order for them to construct successful learning environments.

Thus, this review of research will seek out current scholarship that describes the factors that promote the development of a "technologically competent" teacher, including the personal and knowledge issues that impact the individual as they participate in this developmental process.

Focus of Inquiry

Any study regarding the methods that teachers employ as they learn to apply their technological skills within the classroom context can be informed by research that has already been conducted. Hadley and Sheingold (1993), in their

seminal work regarding teachers who have successfully accomplished the integration of technology into their daily classroom instruction, have laid the framework for such an inquiry. Over 600 classroom teachers who were selected by their colleagues as "accomplished teachers," or teachers who have successfully integrated technology into their teaching, were surveyed. The results of the survey identified three factors that contributed to the success of these teachers.

The first factor, access to the technology "in sufficient quantity" (Hadley & Sheingold, 1993, p. 298), promotes a willingness among the teachers to experiment with ways to use technology as a personal and instructional tool. Lack of access was identified by the authors as one of the top five barriers to technology integration. In the ensuing five years, schools in the United States have made progress in providing access to their students. *Technology Counts '99* (1999), a study which examines the state of educational technology today, reveals that three out of every four U.S. public school classrooms have at least one computer used for instructional purposes, and the ratio of students to computers has dropped from 21 students per computer in 1997 to 13 students per computer in 1998 to 5.7 students per computer in 1999. With this encouraging news, we can suggest that, perhaps, lack of access to the technologies could become less of a factor in promoting technology integration into the daily instructional practices of our nation's classroom teachers.

However, with the advent of more technology in classrooms and larger portions of budgets being utilized to support this infusion, administrators and parents alike will require evidence that technology affects school achievement in a positive manner (Education Week, 1998). Evidence that confirms the links among technology effectiveness, raising student achievement, and improving school climate could provide the impetus for administrators to encourage their teachers to implement computer-based technologies within their instruction. Wenglinsky (1998) reveals that there is a definite positive link between computer use and achievement levels, but that the correlation is dependent upon the teacher's ability to help students use the computer to promote higher-order thinking skills. Wenglinsky found that students whose teachers used simulations and applications scored higher on the 1996 National Assessment of Educational Progress math exam than students whose teachers reported using computers primarily for drill and practice. The report further indicated that this same factor of more sophisticated computer use by teachers related positively to a better school climate with higher teacher/student attendance, less tardiness, and better morale. *Technology Counts '99*, the annual report from Education Week that reviews the state of technology use in our nation's schools, stated that "competent teachers are needed to invoke academic gains from digital content" (Education Week, 1999). Henry Becker, in an interview for the journal, Technology and

Learning, emphasized that his studies, periodic surveys of teachers and their use of technology in the classroom, have shown results which " seem to point in the positive direction when it comes to software's impact on skills learning," especially when "teachers rethink their major goals" and "move toward constructivist teaching rather than focusing on individual skill components. Then technology can be incredibly valuable" (Salpeter, 1998b). Studies such as these demonstrate that technology can help to impact achievement, but to achieve positive impact, teachers must be trained to provide technology-enhanced environments that promote higher-order thinking skills.

Hadley and Sheingold (1993) identified this school-wide atmosphere that promotes higher order thinking skills as a key component of a quality learning environment. They further identified training opportunities and securing on-site support personnel to support teacher efforts as being "critical to successful technology use" (p. 299) and the second factor that influences the development of "accomplished teachers" who use technology successfully. With evidence of progress in providing teachers with access to technologies and a collegial, supportive school culture that encourages teachers to infuse use of technology into their teaching, predictions of widespread application among teachers might seem possible. However, Hadley and Sheingold remind us that there are three factors that influence the successful integration of technology, and the three

factors "do not operate alone, but together, to mutual benefit and effect" (p. 298). Therefore, the third factor, the teacher's own motivation and commitment to their students' learning and to their own development as teachers, must be explored before predicting large-scale generalizations of success. (See Figure 2.1.)

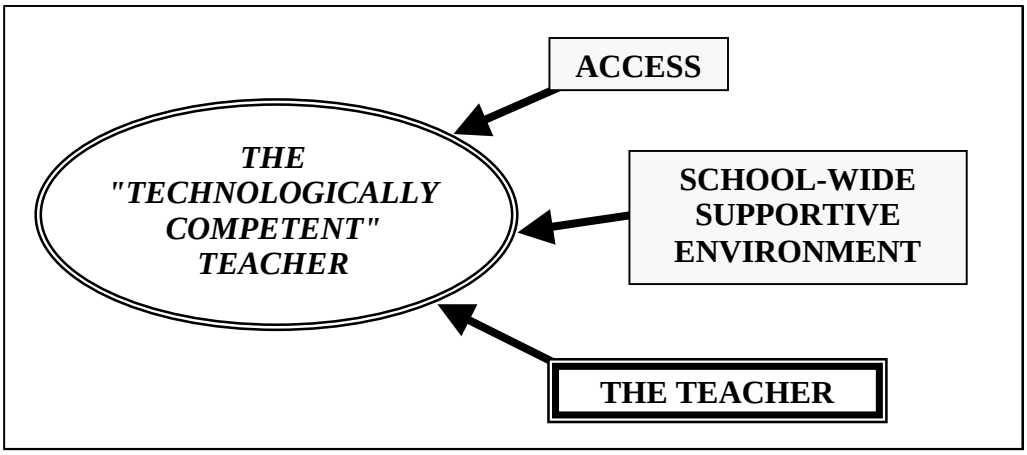


Figure 2.1: The three factors that contributed to the successful development of technologically competent teachers (Hadley & Sheingold, 1993).

With a consensus that access and training/support issues are important and work toward resolving these issues occurring, the realization that the teacher is the most important piece of the technology integration puzzle needs to emerge. Thus, identifying the characteristics and teaching practices of "accomplished teachers" plus providing all with situations similar to those experienced by "accomplished teachers" is a good first step toward motivating teachers to integrate technology into their classrooms.

However, these descriptions of characteristics and teaching practices are drawn from generalizations about teachers who use computers in teaching (Becker, 1994; Becker, Ravitz, Riel, & Wong, 1999; Hadley & Sheingold, 1993) and may or may not describe the teaching practices of the individual teacher who, for a multitude of reasons, may be later in adopting newer innovations into teaching practices. This individuality of the teacher must be addressed. As the 1998 SIER*TEC report states, "No matter how many computers are available or how much training teachers have had, there are still substantial numbers who are 'talking the talk' but not 'walking the walk' (SEIR*TEC, 1998, p. 3). Identifying the issues perceived by the individual teacher as necessary for integration, building upon these perceptions, and providing training that supports these individual needs may be the key to promoting successful integration.

Therefore, the focus of this inquiry investigated the teacher, called "the single most important variable in instruction" by Kati Haycock, director of a Washington-based research and advocacy group for low-income students (Brooks, 1999, p. A12). First, we looked to the literature to identify the individual characteristics that influence how a teacher teaches in a technology-enhanced environment. These characteristics include the following:

- Teaching and computing experiences;
- Personal beliefs and attitudes regarding effective teaching and the role of technology within those effective teaching practices;

- The individual's "teaching personality," or the personality traits that impact teaching practices of the individual teacher.

Secondly, we examined the knowledge base that a teacher needs in order to construct an educational environment that stimulates student. This knowledge base includes the following:

- Creating an educational environment based on current cognitive theory that stimulates student learning and that uses a variety of models to deliver instruction;
- Designing appropriate activities that demonstrate teacher understanding of the relationship between the functions of basic computer applications and student learning;
- Managing a technology-enriched learning environment.

As the study being proposed was an exploration of "the nuances pertaining to how teachers negotiate technical change through their daily routines" (Evans-Andris, 1995b, p. 16), the personal variables and the knowledge issues addressed in the literature (and as shown in Figure 2.2) provided the framework for this proposed study.

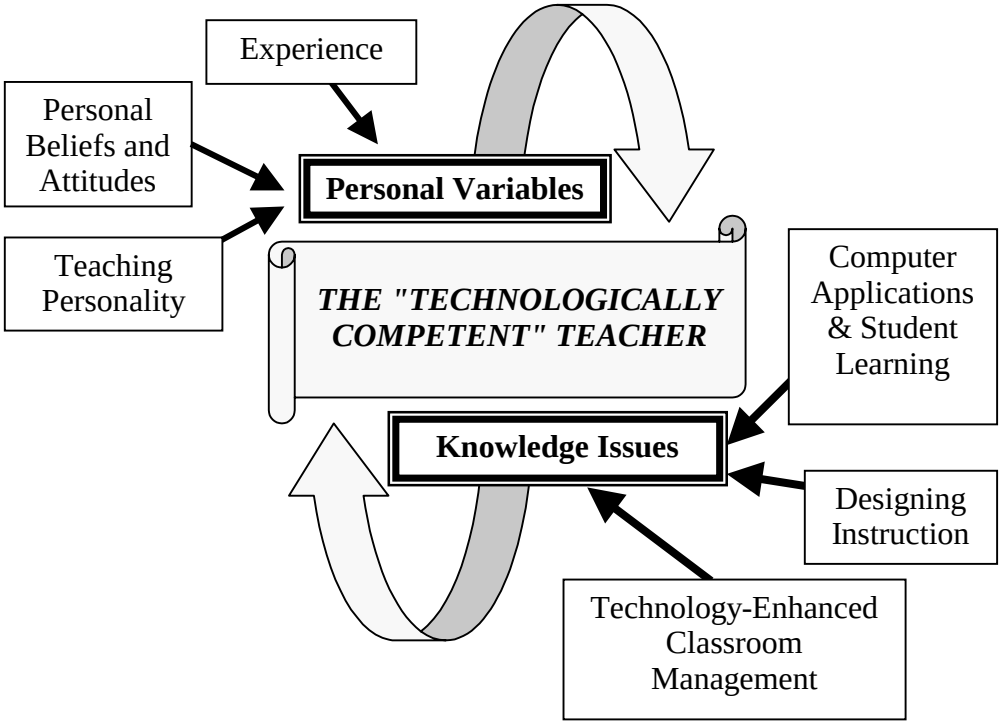


Figure 2.2: The two sets of factors, and contributing characteristics, derived from the literature, that influence teachers as they learn to become "technologically competent."

PERSONAL VARIABLES/CHARACTERISTICS OF THE INDIVIDUAL TEACHER

Generalizations regarding the characteristics that describe the "accomplished teacher" were difficult even for Hadley and Sheingold to make in their 1993 study. Because each teacher is an individual with varying degrees of experience with technology, differing teaching practices, and ever-changing knowledge about using computers for teaching, one "profile" of a teacher who integrates technology successfully could not be constructed. However, certain

personal characteristics have been identified within the research that describe teachers who incorporate technology into daily instruction. These characteristics include teaching and computing experiences, personal beliefs and attitudes regarding effective teaching, the role of technology within those effective teaching practices, and the individual's "teaching personality," or their perception of the teacher's role including how that perception reveals itself through teaching practices.

Teaching experience and experience using computers

In a study that sought to differentiate between exemplary computer-using teachers and other computer-using teachers, Becker (1994) found that "developing expertise in using computers in teaching comes with time and experience -- time spent using computers and time spent learning to teach well" (Becker, 1994, p. 309). Hadley and Sheingold (1993) similarly found that "accomplished teachers" have been in the teaching profession for an average of thirteen years and have been using computers for at least five years. These two components: number of years of experience in the classroom and familiarity with computers and their use in teaching are associated with a teacher's ability to successfully integrate technology into the classroom.

Fuller (1969) and Fuller & Bown (1975) explained the effect of experience upon a teacher's ability to adapt to innovations as a process of

evolving through various levels of concern. Novice teachers focus upon themselves and whether or not they can control their students. Fuller described the concerns of a novice as "concerns with self" (p. 216) which included doing well on evaluations by supervisors, determining whether their pupils like them, and acquiring skills that allow them to survive in the classroom (Borich, 1993; Burden, 1986; Ryan, 1992). As the teacher acquires these experiences, priorities shift towards improving teaching skills and delivering quality instruction, or "stages of task." (Borich, 1996, p. 119; Fuller, 1969). A teacher in this second stage will address concerns for mastering the content, designing effective instructional strategies, and delivering subject content effectively. After developing confidence in management and lesson delivery skills, Fuller suggests that the concerns naturally shift to "impact concerns," or the impact the teacher has on the learner (Borich, 1996, p. 120). Thus, experienced teachers are concerned with developing instruction that is student-centered, motivating, and providing the best learning opportunity for the student. Teachers in this stage are seeking new and different methods of providing instruction to their students, and may be more open to adopting innovations into their teaching practices (Hord, Rutherford, Huling-Austin, & Hall, 1989).

Although "time spent learning to teach well" (Becker, 1994, p. 309) impacts the ability of the teacher to concentrate on creating instruction that

promotes student learning, the teacher's comfort level with computers and computer use within the instructional setting also impacts the integration of technology into the creation of effective instruction. Many research studies, (Campbell, 1992; Delcourt & Kinzie, 1993; Liu, Reed, & Phillips, 1990; Olivier & Shapiro, 1993; Troutman, 1991), have indicated that self-efficacy with technology use, or the belief that users hold regarding their ability to be personally effective with computers, increases with familiarity and training. Dwyer, Ringstaff, and Sandholtz (1990) identified five stages of this evolution: Entry, Adoption, Adaptation, Appropriation, and Invention. Entry is characterized by developing coping and survival strategies needed to resolve problems with the physical environment, the day-to-day technical hassles, student misbehavior, attitudes, and classroom dynamics that stem from the interactive nature of technology. Adoption occurs next as the teacher progresses through the management struggles of Entry, and begins using the technology in daily teaching practices. During the Adoption phase, teachers utilize technology as a means of supporting the teaching practices developed throughout their teaching careers. Adaptation occurs when the teacher begins to design instructional tasks that allow the student to use the technology independently as a learning tool. At some point, the teachers reach a comfort level with their role as a facilitator of learning, reach a personal mastery of the technology, and envision technology as a tool "to

accomplish real work." (p. 5). At this point, new instructional patterns emerge, and team-teaching, interdisciplinary projects, or individualized projects become common. Dwyer, et al. (1990) refer to this phase as Appropriation, a precursor to the final stage of Invention. Teachers who have evolved into the Invention stage will be the pioneers for future development of learning environments that seamlessly integrate technology into instruction.

Summary

The research regarding exemplary or "accomplished" computer-using teachers indicates that as teachers gain experience teaching and teaching with computers, they become more comfortable with using the technology to enhance student motivation, interest, and learning, incorporating technology into their teaching in such a way that "It would be hard to live without a computer…It has become a way of life" (Sandholtz et al., 1990, p. 5). Yet, the process of acquiring "technological competence" (Lowther et al., 1998, p. 98) is an evolutionary process that requires time.

Personal beliefs and attitudes about teaching and technology

The process of developing an individual teacher's "technological competence" may be impacted by factors other than experience with teaching and teaching with computers. An individual's beliefs and attitudes about what constitutes effective teaching and the role of technology within that instructional

situation may be a strong influence upon the educational decisions and classroom practices of an individual. Pajares (1992), in a review of the literature regarding teacher's beliefs, states that "beliefs are instrumental in defining tasks and selecting the cognitive tools with which to interpret, plan, and make decisions regarding such tasks; hence, they play a critical role in defining behavior and organizing knowledge and information" (p. 325). Therefore, the areas of an individual's belief system that impact the ability of the individual to infuse technology into their individual teaching practices include the beliefs the teacher holds regarding what constitutes effective teaching, the role of the teacher in delivering effective instruction, and the role that technology should play in the overall instructional setting.

Studies, such as Weade & Evertson (1988), indicate that teacher efficacy, or the "extent to which teachers believe that they have the capacity to affect student performance" (Ashton, 1984, p. 28), is reflected in their construction of the learning situations that positively influence student achievement. Hadley & Sheingold (1993) stated that "accomplished teachers" were motivated to find additional uses for technology in their teaching because they could see patterns of practice that directly impacted student achievement. These patterns included a higher teacher expectation of student work, a teacher's ability to individualize instruction, and the change from a teacher-centered into a student-centered

classroom. In fact, Hadley & Sheingold identified one profile of "accomplished teachers" in which the teachers were not as technically competent as other profiles. The individuals in this profile, most of whom were novice users of technology, believed so completely that technology would impact student learning that it should become an inherent component of daily instruction. They were committed to acquiring training and using technology with their students.

Teachers describe effective teaching as experiential knowledge that helps the teacher to "survive" in the classroom, "cope" with difficulties that arise, or "shine" as an exemplary teacher because of student achievement (Orton, 1996). Teachers may have learned that the five elements of effective teaching are considered to be lesson clarity, instructional variety, teacher task orientation, student engagement, and success rate (Borich, 1996), but the experiences of the individual teacher will determine to what extent that teacher believes these elements are effective. For example, a teacher who experiments with instructional variety will be encouraged to continue using those examples of instructional variety that have proved successful with his/her students. Orton (1996) explained this phenomenon by stating that "teacher beliefs are not rooted in general theories of learning, cognition, and instruction, but in what has worked in the past, situations, particular instances, trial and error, and 'muddling through' " (p. 140).

The set of beliefs that form the foundation for the manner in which the teacher views his or her role in the classroom strongly impact the decisions a teacher makes regarding the design of instruction, the delivery of instruction, and the nature of the learning environment. Researchers describe these beliefs as falling along a continuum from student-initiated discovery and exploration on one end of the continuum to teacher-directed, teacher-initiated learning situations at the other end (Frazee & Rudnitski, 1995; Mangione & Maniates, 1993). For example, activities that fall at the end of the continuum for student-directed, student-initiated discovery and exploration result in independent studies that are initiated by the interests of the student, designed by the student, and evaluated by the student. The role of the teacher in a learning situation such as this would be to serve as a mentor, coach, or facilitator of the learning process. At the other end of the continuum are the learning situations that are totally designed by the teacher, delivered by the teacher, and assessed by the teacher. In this type of learning situation, the role of the teacher is to control the learning environment, disseminate information, and assess the student's ability to process the information. The teacher's beliefs as to what the role of the teacher should be, based upon teacher perceptions of the learning needs of the students and effective instructional tasks in which this type of learning best occurs, will determine the individual's choices when designing instruction. Hadley & Sheingold's (1993)

"accomplished teachers" indicated a preference for student-centered instruction and viewed their role as the "guide on the side" rather than the "sage on stage," terms describing classroom roles teachers portray (Cifuentes, Davis, & Clark, 1996). Becker's (1994) “exemplary teachers” utilized small group work, with each group working on a variety of software and tasks. Saye's (1998) “voyageurs” kept the classroom focus on the students in a flexible, experimental learning environment. Robin & Harris (1998) found that technology-using teacher educators preferred learner-centered teaching approaches. It would appear from this variety of research that teachers who are successfully incorporating technology into their classrooms have developed a comfort level with playing the role of facilitator in the instructional process.

In fact, proponents of educational reform were expecting technology to become the catalyst for widespread change in teachers from "dispensers of knowledge" to facilitators (Collins, 1991; Dwyer, Ringstaff, & Sandholtz, 1990a). Becker (1998) found that this was not the case, as the majority of teachers using technology today are utilizing only the "more mundane capabilities that technology provides" (Becker, 1998, p. 29), such as drill and practice to supplement skill instruction. Drill and practice applications of technology tools have been a part of classroom use since the early 1980’s, and as such could be viewed by teachers as a part of “what has worked in the past” (Orton, 1996, p. 140). Proven to be stronger than teacher knowledge about cognitive learning

theory or effective teaching, Orton (1996) suggests that an individual's belief about their role as the teacher in instruction is only altered when the teacher views personal experiments with innovative instruction as successful teaching and learning experiences. He further proposes that teachers perpetuate the status quo in classroom instruction as long as these views of personal beliefs are not altered.

Providing teachers with technology-enhanced experiences that promote successful teaching with computers in the classroom is a critical component of assisting them in becoming "technologically competent." Salinas & Kozuh (1998) describe the process as one of understanding the relationships among the needs of the students, the role of the teacher, and the role that instructional technologies can play in the instructional environment. This synergy that develops between the empowerment of the student in an instructional setting and the use of technology is described by Salinas & Kozuh (1998) as fluctuating. As the "needs of the students change, and with them the role of the instructor, so varies the role instructional technologies can play in the classroom" (Salinas & Kozuh, 1998, p. 2). Salinas & Kozuh further explain the process as a dual pyramid, as shown in Figure 2.3.

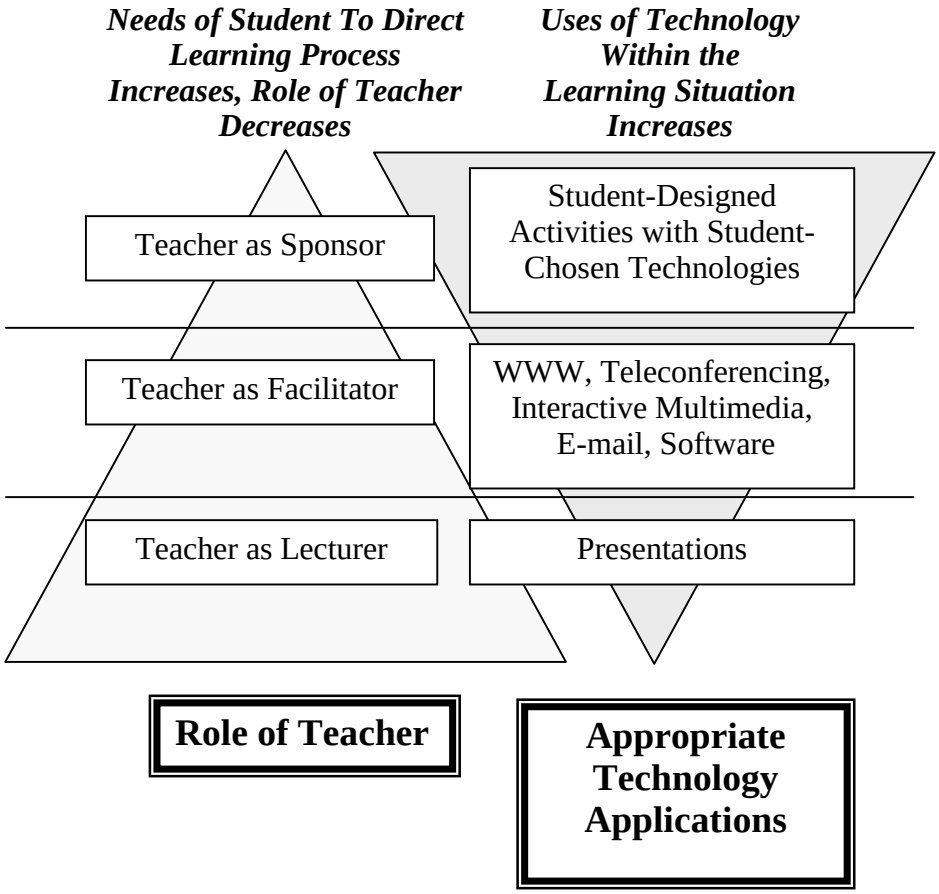


Figure 2.3: Dual Pyramid Design depicting that "when the needs of the student are more closely related to internal awareness, self discovery, and non-judgmental support, the role of the instructor becomes that of a facilitator and a delegator, and the function of technology is greater, as a main resource for information, a guide, a monitoring and feedback device, and a tool to facilitate and encourage individual exploration and creativity" (Salinas & Kozuh, 1998, p. 3)

When the role of the instructor is the greatest and instruction is more modeling-centered, the function of instruction technologies is quite limited. On the contrary, if the role of the instructor is less intrusive, the function of technology is greater" (Salinas & Kozuh, 1998, p. 3).

In other words, the instructional block of time is divided between time the teacher spends lecturing or giving information and directions, and the time the student is actively seeking information and in charge of his/her own learning. During teacher-centered instruction when the role of the teacher is that of lecturer or “dispenser of knowledge,” the student assumes a more passive role of listener. Technology that can be used in this instructional situation is limited to presentational tools and brief encounters with drill and practice. On the other end of the continuum is the learner-centered instruction in which the role of the teacher is to serve as a sponsor or “guide on the side.” The instructional time is characterized by the use of student-designed activities with student chosen technologies and very little time for teacher-dispensed information. A variety of technology tools could be used to support these learning situations.

Evans-Andris (1995) suggests that teachers who understand the relationship among technology, the role of the teacher, and student learning "organize their classrooms and teaching styles around the computer and continually explore new opportunities" (Evans-Andris, 1995b, p. 98). With this

understanding as a foundation, teachers are able to creatively enhance the classroom learning experience, improve and develop their teaching skills, and promote the idea of using computer technology in their schools (Evans-Andris, 1995a; Hannafin & Freeman, 1995). Teachers without this understanding often view the computer as a "means of occupying students' attention so that the teacher's interaction with students is not necessary….Teachers whose methodology reflects these attitudes and beliefs about computers often play a detrimental role in effective computer implementation" (Evans-Andris, 1995b, p. 97). *Technology Counts '98*, a report published by Education Week, confirms that, although technology can have positive benefits for student achievement, when computers are used for the wrong purposes, such as with drill and practice activities that only promote the use of lower-order thinking skills, "computers appear to do more harm than good" (Education Week, 1998, p. 1). Therefore, teacher beliefs about the role of technology within instruction and the application of these beliefs in teaching practices may be a critical factor in the successful development of a "technologically competent" teacher.

Summary

The beliefs that an individual teacher holds regarding what constitutes effective teaching, the teacher's role in the instructional environment, and the understandings related to the successful use of technology tools within that

instructional environment significantly influence the decisions that teacher makes regarding planning and implementing instructional design. Supporting teacher beliefs and attitudes during the teacher's process of becoming "technologically competent" may become a critical factor in their success.

"Teaching Personae" or personality traits that impact teaching practices

To determine the influence that the three groups of personal variables pertinent to this review have upon a teacher's ability to develop "technological competence," researchers are required to identify each of the variables. Experience can be easily determined by counting the number of years a teacher has been teaching or the length of computer training a teacher has received. The second variable, teacher's beliefs and attitudes that guide individual teaching practice, can be ascertained through observations, interviews, as well as more formal assessment tools such as attitude inventories. However, a third variable, one that greatly impacts a teacher's ability to integrate technology, proves to be more difficult to identify.

Certain personality traits, such as willingness to participate in new situations, enthusiasm for adopting new ideas, need to control teaching situations, desire for predictability and structure, or commitment to student learning, are mentioned by Saye (1998) as also shaping the individual's "teaching persona." Identifying these characteristics that comprise an individual's "teaching

personality" is a necessary process in order to develop training that promotes technology integration for that individual.

Decisions that teachers make regarding the addition of technology to their instruction is explained by Saye (1998) as "hinging on individual teachers' personalities and beliefs" (p. 232). Becker (1994) found that exemplary computer-using teachers were motivated to learn and demonstrated a broader use of applications as they acquired more skills, and were therefore better educated and more committed to a life-long learning process. These individuals represent a group of teachers who have sought out training and persevered in order to learn new skills. Rogers (1995) would have explained this pattern by classifying these individuals as innovators, or adventurers who will be among the first to try new ideas regardless of risk of failure, and early adopters, or leaders who successfully use innovations and serve as role models for others. Smith, Kleine, Prunty, and Dwyer (1992) describe innovative teachers as having personality dispositions that are different from those of other teachers. And, Schlechty (1993) states that there are different types of teachers whose needs must be met in order for reform or innovation to occur. He discusses further this concept by identifying five types of teachers that vary in their tolerance for risk: “trailblazers, pioneers, settlers, stay-at-homers, and saboteurs” (Schlechty, 1993, p. 46).

Saye (1998) labels this critical ability of teachers to "vary the amount of risk, ambiguity, and adventure they admit into their classrooms" as "disposition comfort with uncertainty," and suggests that this ability may be a critical component in the teacher's successful classroom-based use of technology (p. 232]. Saye places teachers on a dispositional continuum. One end of the continuum is bounded by “Accidental Tourists,” or teachers described as seeking "predictable familiarity" by "minimizing potential disruptions in their normal, comfortable routines" with technology uses that "reinforce, rather than challenge, their established patterns of classroom interaction" (p. 224). On the other end of the continuum, we find “Voyageurs,” or teachers who "relish risk and unpredictability" and who are stimulated by technology to "explore and experiment with new approaches to expand the possibilities of schooling" (p. 224).

In addition to personality traits that show a preference for adopting innovations and a comfort level with risk and ambiguity, personal comfort with placing control of the learning situation in the hands of the learner may determine a teacher's selection of technology goals (Saye, 1998). For example, teachers who feel the need to maintain control of the learning environment and are more comfortable with the role of "expert" tend to prefer teacher-centered learning environments and select technology goals that are "essentially content transmission, drill and practice, [or] word processing” (Saye, 1998, p. 227).

Teachers whose personalities allow them to relinquish power so that students control the learning environment tend to prefer learner-centered activities and select technology goals that emphasize play, exploration, and discovery (Evans-Andris, 1995b; Howard & Howard, 1994; Saye, 1998).

Summary

Personal characteristics, such as willingness to explore and experience new situations and innovations, the flexibility to handle learning situations that include varying degrees of order, predictability, or risk, and the ability to share classroom control of the learning situation with students influence the teaching practices of the individual teacher. In addition, teachers make decisions regarding technology goals based upon these personal characteristics.

KNOWLEDGE ISSUES REQUIRED FOR TEACHER CONSTRUCTION OF TECHNOLOGY-ENHANCED LEARNING ENVIRONMENT

Just as the experiences, personality traits, personal attitudes and beliefs of an individual mold the persona of the teacher and impact the manner in which that individual is able to utilize technology in their teaching practices, there are certain issues related to a technology-enhanced learning environment with which the teacher must be familiar. These knowledge issues are represented in the following questions.

- How does current cognitive learning theory describe the characteristics of the optimum-learning environment; one that stimulates the deepest of student learning?
- What are the models that can be used to design instruction that promotes such optimal student learning?
- What relationships exist between the functions of basic computer applications and their ability to enhance student learning?
- What classroom management techniques are essential for successful implementation of a lesson in a technology-enhanced learning environment?

The extent of a teacher's expertise in each of these knowledge issues and the ability to design effective instruction that reflects this knowledge is a critical part of becoming a "technologically competent" teacher.

Designing the learning environment according to cognitive learning theory

Among the most important pieces of knowledge a teacher possesses may be the understanding of current research and theory regarding how a student learns, the processes that promote the deepest understanding within that student, and the necessity of constructing an environment that supports this type of learning. Without this basic understanding, teachers will continue to teach as they were taught (Orton, 1996). Morrison, Lowther, and DeMuelle (1999) suggest that the American view of the "traditional" teaching system was created to supply workers needed for the factories of the Industrial Revolution and produced individuals that were "obedient and competent workers" (p. 5). The workplace of

today requires a different type of individual. That individual is able to probe and question, work independently, and communicate with and work within a team. In order to create a learning environment that produces such students, educational reformers have turned to the field of cognition and learning theory. Zemelman, Daniels & Hyde (1998) describe a new paradigm of learning and teaching that is dependent upon "thirteen inter-locking principles, assumptions, or theories" (p. 7) that combine to produce the educational situations that assure deep learning and processing within the learner. These characteristics are shown in Figure 2.4.

As these thirteen characteristics, as well as others, evolved from the current theories of cognition and learning theory and serve as building blocks with which to build quality instruction, an Instructional Psychology Class (1998) used these characteristics to develop a rubric designed to evaluate an instructional activity, unit, or course based on the instruction's potential for promoting deep

Child-Centered	School reflects child's real interests, concerns and questions
Experiential	Active, hands-on, concrete experiences provided with student immersion in direct experience
Reflective	Learner receives opportunities to "look back, to reflect, to debrief, to abstract from their experience"
Authentic	Curriculum developed from real world experience
Holistic	Ideas, events, materials taught in context
Social	Classroom activities allow for social interaction to promote scaffolding of learning
Collaborative	Encourage social learning through cooperative learning experiences
Democratic	School is viewed as a community with students as citizens
Cognitive	Use of inquiry and self-monitoring to develop concepts and understanding
Developmental	Instructional activities should fit the developmental level of learner
Constructivist	Activities promote student construction of knowledge
Psycholinguistic	Activities promote language as a primary tool for learning
Challenging	Activities that challenge students with choice and responsibility promote learning

Figure 2.4: Thirteen principles that characterize learning environments that promote optimal student learning (Zemelman, Daniels, & Hyde, 1998, p. 7-8)

understanding and learning. The rubric organized the characteristics into four categories (See Figure 2.5 on the following page):

- Level of Learning Characteristics (Inclusion of authentic, student-centered learning through real world relevance);
- Structure of Instruction Characteristics (Inclusion of certain instructional characteristics that lead to deep processing of information);
- Student Awareness Characteristics (Inclusion in the instructional design that allows for student awareness);
- Motivational Characteristics (Inclusion in the instructional design of motivational elements) (Instructional Psychology Class, 1998).

Instruction that is designed to incorporate elements from each of the four categories provides students with ideal learning experiences. Consequently, the strongest learning opportunities are designed with as many elements from the rubric as possible. For example, an instructional activity designed to incorporate a majority of the characteristics contained within the chart provides the student with a deeper learning experience than activities that contain components from only two categories of the rubric.

Component 1: Level of Learning Characteristics (Presence of these characteristics indicates depth of processing for student learning)	***Component 2: Structure of Instruction Characteristics (Presence of these characteristics provides organized and supportive learning environment)***

• Focus is on meaningful learning through real world relevance
• Encourages deep processing by aiming at:
  • Organization
  • Conceptualization/abstraction
  • Integration
  • Application
  • Consideration of multiple perspectives
• Provision of models that reflect on the field in general
• Encourages development of cognitive epistemology through challenge and support
	• Organized structure of task or content (goals, objectives, expectations, clarity)
	• Provides prototype of outcome with essential features highlighted
	• Builds on prior knowledge of students
	• Facilitates acquisition of key concepts through use of analogies, examples, images
	• Emphasizes active learning, including distributed practice, collaboration
	• Models desired behavior
	• Scaffolds learning through questioning, coaching, guided discovery, support, and feedback
	• Mastery promoted during initial learning episodes
	• Training occurs within context, culturally situated

Component 3: Student Awareness Characteristics (Presence of these characteristics indicates opportunities for student construction of knowledge)	***Component 4: Motivational Characteristics (Presence of these characteristics indicates promotion of student interest)***

• Flexible structure to adapt to student needs
• Starts with or draws on prior knowledge
• Method is able to target students' zone of proximal development
• Built in reflective mechanism to monitor student progress
• Structured to support self-regulated learning
  • Teaches strategies
  • Allows for practice of self-regulated learning
	• Interest provoking, optimal novelty
	• Relevant
	• Learner choice available
	• Timeliness
	• Challenge
	• Clear expectations
	• Learning goals foci
	• Builds self-efficacy

Figure 2.5: Evaluation Rubric for Instructional Critique Criteria (Determining if a learning situation provides for optimal student learning) (Instructional Psychology Class, 1998)

Morrison, Lowther, & DeMuelle (1999) take a different approach towards establishing components of the learning environment that are conducive to technology integration. These components are described as an open-ended learning environment, learning context that incorporates authentic learning and situated cognition, and collaborative learning. In contrast to the Instructional Psychology Class (1998) Evaluation Rubric which suggests that instruction be designed with components from each of the four categories, Morrison, et al. (1999) propose that basing a learning environment upon open-ended learning activities which are designed to be accomplished in an authentic, real-world context and by groups of students working collaboratively are the only criteria needed to provide a learning environment such as the one supported by inclusion of the four categories of the Evaluation Rubric. The authors describe this type of learning environment as naturally lending itself to the inclusion of technology.

Summary

The paradigm of teaching and learning that best promotes student learning must be an area of knowledge that the individual teacher brings into the instructional design process. Although teachers may not always rely upon their knowledge of cognition and learning theory, they should be aware that the research favors a teaching paradigm that encourages student-centered, active

learning situated within an authentic context and values the interests and inquiries of students.

Designing instruction using a variety of instructional models

Once the teacher understands and is able to identify the characteristics that are crucial to a quality learning environment, incorporation of these criteria into the lesson design requires that the teacher be familiar with different models of teaching. Joyce & Weil (1996) describe more than 22 teaching models used by teachers to deliver instruction that present information, extend and enhance concept development, help students to demonstrate skill performance, or promote problem solving. As each of the different models of instruction encourage different styles of learning, the teacher learns to match the objectives of the lesson with the appropriate model of instruction. For example, Gunter, Estes, and Schwab (1990) explain that the instructional model most appropriate for developing information recall and skill acquisition is the direct instruction model. Categorization, generalization, and synthesis of information are best achieved through the concept development model. The process of developing the ability to deliver instruction using different models, or developing a teaching repertoire, strengthens the teacher's instructional prowess. Freiberg and Driscoll (1992) further define the teaching repertoire as "an accumulation of skills, concepts, and attitudes based on a person's universe of knowledge and experiences" (p. 3). By

developing a repertoire of teaching models, teachers are able to provide their students with a "rich array of learning environments" (p. 375) to meet the variety of students' learning needs.

Not only should teachers be aware that different models of instruction are valuable for effectively addressing different learning objectives, but teacher awareness of which models lend themselves to incorporation of different technological tools encourages technology integration. Morrison, et al. (1999) advocate using models of instruction that emphasize open-ended learning, such as inquiry learning, collaborative learning, problem solving, and guided design, as these models are easily adjusted to incorporate technology use into the lesson design. Each of these models promotes learning through student-centered lesson design in which the teacher acts as a facilitator and the students construct their own knowledge.

Dwyer, Ringstaff, & Sandholtz (1990) predicted the advent of creative new learning environments that seamlessly integrate technology as a natural outgrowth of teaching within technology-rich classrooms. Once teachers become comfortable enough with teaching and designing technology-enhanced instruction to consider technology to be an "instructional partner" (McDaniel et al., 1994) and an integral part of the instructional design, the development of newer models of teaching or frameworks of lesson design may emerge.

The NteQ Model, which is the acronym for "iNtegrating Technology for inQuiry," is one such model. NteQ has been designed as a framework for creating open-ended learning environments by "examining the roles of the teacher, the student, the computer, the lesson, and the environment itself" (Morrison et al., 1999). The authors advise that the NteQ model is not appropriate for every instructional situation. However, once the teacher has determined that using a particular technology is the best method for addressing the learning goals, technology-enhanced instructional activities are designed based upon the philosophy that:

- Teachers are designers, managers, and facilitators.
- Students are actively engaged as researchers.
- Computers are tools that support the learning process.
- Lessons are student-centered, based on authentic problem-solving.
- Learning environments are multi-dimensional, or employing multiple resources, activities, and student groupings to accomplish the learning goals (Morrison et al., 1999).

As teachers design instruction using the NteQ model, special attention is given to matching the learning objectives to the functions of the computer so that using the computer as the best tool to solve the problem is a logical choice for the student.

Another framework for designing instruction that creates student-centered, collaborative learning environments is a set of “activity structures”. Harris (1998) compares activity structures, or frameworks that undergird instructional activities and support the context and content of the learning experience, to the structural frame of a house which fortifies the living spaces constructed within so that "the same frame can support many houses whose external appearances and intended functions are actually quite different" (p. 12). Although Harris limits the discussion to eighteen activity structures identified for use in telecollaborative environments, the learning processes of interpersonal exchange, information collection and analysis, and problem solving, which thread through telecollaborative activity structures, are common to other technology-enhanced environments. Thus, the telecollaborative activity structures could additionally serve as frameworks for teacher design of learning environments that utilize other types of technology. For example, among the problem solving activity structures that Harris (1998) describes is "sequential creations," in which "participants progressively create either a common written text or a shared visual image" (p. 46). A lesson could be designed based upon this same activity structure that would use a word processing program to produce a document in which class members or groups of members collaborate to create a finished product.

Summary

Developing a repertoire of instructional models that not only support student learning, address a variety of learning goals, and promote learning across a variety of learning styles, but also endeavor to incorporate use of technology as a seamless part of the learning environment, are important tools for instructional design. Since teachers tend to use teaching models that reflect their own learning style preferences (Howard & Howard, 1994), they need to be cognizant of relationships between instructional models and learning objectives. Models of instruction (e.g., collaborative learning, inquiry learning, and problem solving) used to deliver learner-centered activities such as those constructed with the use of activity structures appear to present learning environments that fully optimize the potential of technology to support learning goals. As Hadley and Sheingold first asserted in 1993, one of the characteristics of an "accomplished teacher" is that they are able to design instruction using models and activities such as these.

Recognizing relationships between functions of basic computer applications and student learning

Once the teacher has identified models of teaching that can be effectively enhanced with technology, s/he must possess the necessary knowledge to be able to match the objectives of the instruction with the functions of the computer applications. Papert (1990) describes teachers who are not able to use technology tools to support the purpose and intent of the instruction as “technocentrists,” or

those who tend “to give a similar centrality to a technical object--for example computers or Logo." Characterized by “a tendency to think of "computers" and of "Logo" as agents that act directly on thinking and learning; they betray a tendency to reduce what are really the most important components of educational situations--people and cultures--to a secondary, facilitating role (Papert, 1987). These teachers focus upon the tools and contrive lesson instruction so that the purpose of the instruction is for the students to use the tools, rather than utilizing the tools to enhance curriculum-supported instructional goals.

“Accomplished teachers" discuss their use of technology as it functions in the lesson structure, rather than through the software applications themselves (Hadley & Sheingold, 1993). For example, realizing that a database functions as a tool that can sort, match, find and group sets of information allows the teacher to incorporate the use of a database into lessons that require the student to perform those functions. Word processors are useful tools for listing, recording, and manipulating text and could be incorporated into lessons which require the students to record thoughts in journals, communicate and share ideas with others, or describe similarities/differences observed (Morrison et al., 1999).

Summary

Becker (1998) stated that teachers:

> need to attain a sophisticated understanding of both the technical aspects of many different technology-based programs and how they may be used

> in pedagogically effective ways to improve students' conceptual understanding, their ability to investigate and learn on their own, and their motivation to do so (p. 29).

The lack of research in this area indicates that providing the link between software capabilities and student action while learning is a new and emerging area. Morrison, et al. (1999) suggest that teachers must possess the knowledge necessary to use technology as an enhancement to learning rather than focusing lesson design upon the technology, and as such, is a critical component of an individual becoming "technologically competent."

Management of a technology-enriched instructional environment

Classroom management is not a skill that is mastered once and for all. As classroom contexts change, so do the classroom management issues (Sandholtz et al., 1990) as summarized by (Morrison et al., 1999).

> Weade and Evertson (1988) highlighted the positive relationship between the effectiveness of a teacher's management of the learning environment and student achievement. "Technologically competent" teachers have developed the ability to execute instruction within a multidimensional learning environment that is student-centered and includes the movement of students, management of multiple resources, and construction of activities that effectively utilize technologies and resources (Sandholtz et al., 1990). Lowther, et al. (1998)

describe these multidimensional learning environments as composed of three elements: "the configuration of the students, the learning tasks, and the supporting resources (i.e., the computer, hands-on manipulatives, calculators, experimental equipment, reference materials, etc.)" (p. 99). The success of the

multidimensional learning environment relies upon the effective management of these three components.

Sandholtz, et al. (1990) describe the experience teachers had during their first year in a technology-rich teaching environment as the struggle to conquer the managerial issues of working with technology in the classroom. The authors noted that "instructional innovation is not likely to occur until teachers have achieved a significant level of mastery over management issues" (Sandholtz et al., 1990, p. 3). Each teacher working to infuse technology into their daily teaching practices will experience many of these same frustrations.

First, teachers find that lesson planning and design that addresses not only what the students are to accomplish in the activity, but also pre-computer activities, post-computer activities, and routines for participating in such a learning environment, are essential to successful technology-enhanced instructional environments (Dwyer et al., 1990a). Morrison, et al. (1999) state that the teacher must also be prepared to deal with three additional activities that will occur during the learning situation: "assisting students who need help with computer skills, dealing with any technical problems, and keeping students on task" (p. 85).

In addition to resolving coping strategies for dealing with the difference in learning tasks, teachers find that managing student behavior and attitudes in a technology-enhanced environment requires new techniques (Sandholtz et al.,

1990). Teachers in the Apple Classrooms of Tomorrow (ACOT) Project experienced students copying software illegally, cheating on homework, erasing disks with magnets, and failing to complete homework with the excuse that hardware problems at home prevented them from completing the work. In technology-enhanced spaces, there may be an increase in noise and student movement in the classroom. Teachers within the technology-rich environments of the ACOT classrooms had to adjust to the nature of interactions between students and environment which were often more active and boisterous than in the traditional classroom (Sandholtz et al., 1990).

Also, teachers will find that managing students will include providing them with opportunities for independent computer use, within the classroom or computer lab. Teachers who allow high student involvement with the technology often find that the students develop a "computer learning culture." Ryba and Anderson (1993) describe this as occurring when students share information, help each other problem solve, and support each other in times of need, both technically and socially. With the goal of developing this type of culture, Morrison, et al. (1999) point out that the computer is typically used in instruction in three ways. First, one or two students per computer can engage in independent work, either within a lab situation or classroom. Secondly, a group of several students can work collaboratively on a project with access to one computer. Finally, when there is only one computer in a classroom, the computer becomes

the basis for a whole group presentation or part of a collaborative center rotation. McClellan (1999) suggests that techniques for using one computer in the classroom could include using the computer as a discussion generator, a presentation tool, or a collaborative learning tool. Kahn (1998) elaborates that managing instruction of software use may be accomplished with whole group presentation, in which the teacher models use of the software for students, and small group follow-up instruction, in which the teacher follows up the instruction by working with small groups of students.

Teachers also need to develop strategies for the successful management of the third component of the multidimensional learning environment, digital resources. Devising techniques for organizing materials, creating procedures for saving work completed and storing data collected, and establishing time constraints for student use of CD-ROMs promotes cooperative student behavior (Kahn, 1998). Something as simple as the testing of equipment and software before the lesson or appointing a student technician for the day may become important to the smooth progression of the instruction and ensure participation of all students in the learning environment (Lowther et al., 1998).

Summary

Recognizing the unique attributes of the multidimensional learning environment (e.g., students, learning tasks, and resources) in which technology-enhanced lessons occur and being prepared to deal with those attributes is one of

the knowledge issues that the "technologically competent" teacher has successfully resolved.

Conclusion

Although each new technology is heralded as the catalyst that will transform instruction and increase student learning, educational reformers had particularly high expectations for "high-tech" technologies, such as computers, laser discs, and video. Reformers were expecting teachers to shift "classroom emphasis from information transmission to information processing" (McDaniel et al., 1994, p. 73) because the computer supports learning environments that cognitive psychologists describe as providing optimum learning potential. Unfortunately, this did not happen (Becker, 1998; Carroll, 1997; Education Week, 1998; Fulton, 1998). Carroll (1997), for example, describes the current state of technology as pervading and changing every aspect of our lives except for the hours spent within school walls.

Many reformers now recognize that "the effective use of technology to develop learning, communication, and information skills is the result of many factors, chief of which are the teacher, her competence, and ability to shape technology-based learning activities to meet students' learning needs" (Fulton, 1998, p. 60). Teachers play a key role in effecting educational change, but researchers such as Cuban (1986), Doyle & Ponder (l977-78), and Lortie (1975) suggest that teachers accept change only when they believe that the change will

help them improve in their own job performance based on their individual perceptions of what their job is (Saye, 1998).

Thus, a large body of research has been conducted to determine characteristics of "technologically-competent" teachers with the implication that other teachers may become "technologically-competent" by emulating these characteristics (Becker, 1994; Hadley & Sheingold, 1993; Morrison et al., 1999; Salinas & Kozuh, 1998; Smith, Kleine, Prunty, & Dwyer, 1992). There is a flaw with this line of reasoning. Smith, Kleine, Prunty, and Dwyer (1992) point out that "technologically competent" teachers share innovative personality dispositions and think differently from others, and Rogers (1995) notes that only 15-17% of the population would be considered to be innovators or early adopters (p. 262). The majority of individuals will adopt an innovation at a much slower rate.

To effect change takes time (Becker, 1994; Hadley & Sheingold, 1993); yet, the nationwide push from legislators, administrators, industry, and parents is to show results now (Education Week, 1998; Fulton, 1998). The conflict between the need for accountability of money spent on training and resources in terms of increased student achievement and the slow process of change creates a dilemma. How does the field of education promote technology use among as many teachers as possible in order to justify money spent while waiting for the change process to occur? If the goal is to get as many teachers using the technology as quickly as

possible, then, perhaps, matching the technology to the teaching personalities of the teachers may be the most efficient method.

The importance of the individual teacher, his/her beliefs that guide teaching practices, individual experiences, personal dispositions towards innovation, and the knowledge they possess regarding how, when, and why technology is appropriate for classroom use, are crucial factors in technology integration. A study that seeks to establish individual teacher profiles with regard to these areas (beliefs, disposition towards innovation, knowledge regarding technology, as well as teaching and learning with technology) and then investigates the learning process that occurs as teachers are introduced to technologies that match their profiles might be helpful in increasing the field's understanding of methods useful for training those of us (68% of the general population) more aptly described by Rogers (1995) as "early or late majority" adopters (p. 264-265).

CHAPTER 3

As a classroom teacher for years and years, I often dreaded attending professional development training. Grumbling because there was a real possibility that I might be wasting a lot of my precious personal time, I would, nonetheless, consider the day of training a success if I was able to bring back one idea or one new teaching technique useful in my own classroom. The success of the training, or lack thereof, was all based upon what I considered to be relevant to my way of teaching and my needs as a teacher.

All too often, I have observed that we, as teacher educators, forget about making technology training relevant in this way. We have agreed that useful technology training incorporates an emphasis on hands-on activities (Meltzer & Sherman, 1997), employs learning that occurs over time by providing continued education (Benson, 1997), provides modeling, mentoring, and coaching (Benson, 1997; Handler, 1993; Office of Technology Assessment, April 1995; Oliver, 1994), and allows post-training access to the technology and the technology trainers (Standish, 1996). But, what about the learning needs the individual teacher views as important?

Most of the technology training I have participated in and conducted concentrates on increasing the teacher's personal skill with operation of computer-based applications. How does one develop technology training that is relevant to

the individual teacher's needs and ways of teaching? What if technology training matched the individual teacher's beliefs about teaching with the use of technology tools in the classroom, and provided participants with an opportunity to practice using tools relevant to their teaching in a low-risk learning environment? It was the purpose of this study to investigate how selected teachers' beliefs and their uses of technology within their teaching practices are related, customizing training according to teachers' beliefs about and practices of teaching.

Overview of Methods

Investigating the relationships between teacher beliefs about learning and teaching and a teacher's ability to use computer applications as part of everyday learning and teaching activities required a study design that explored two aspects of teacher beliefs.

First, what are the educational beliefs of the teacher? Constructing a notion of the beliefs currently held by the individual teacher provided the researcher with two types of information:

- how the individual viewed their roles in the instructional process, from planning to implementation; and
- how these beliefs were incorporated into the individual's teaching practices.

From this information, the researcher, with the help of the individual informant, created a co-construction of a "teaching philosophy," a statement of the teacher's perceptions of his or her beliefs about teaching and learning, and how these beliefs were in evidence in their classroom, at that point in time.

Secondly, how does the teacher believe that technology use can best support his/her notion of teaching and learning? As indicated by the literature review in Chapter 2, there are certain knowledge issues that are related to teaching in a technology-enhanced learning space, such as designing technology-enhanced instruction and classroom management of a technology-enriched environment, that may impact the manner in which an individual is able to utilize computer-based technology within their daily teaching practices. The pilot study for this inquiry (Figg, 1999a), which was also conducted at Corazon Elementary School, revealed that technology training for these teachers had consisted of full faculty, hands-on lab training that emphasized how to use software applications. Only a few days of activities, out of two years of monthly training workshops, included sharing or modeling the use of these technologies in classrooms. The teachers had been given little or no opportunity to work with technology as a support to their personal teaching practices, so in order to investigate how new technological ideas and skills are related to existing beliefs and practices, provision of opportunities to experience working with technologically enhanced instructional

activities created by teachers to meet their students' perceived instructional needs were included in the study design.

The research reported here addressed these issues through a constructivist study which allowed the researcher to first identify the perceived beliefs that individual teachers held regarding the roles of the teacher in instruction and their relationships with their students. Secondly, the participants agreed to work through a process of individualized, participant-directed professional development and acquisition or improvement of technical skills. This consisted of: brainstorming types of technology that, based on their teaching beliefs, were perceived as useful to their instruction and met instructional objectives, developing a plan for acquiring the skills necessary to implement the technology in their instruction, and finally, evaluating the process, its success or lack thereof, determining future steps for continuing the process. A third stage of the research sought to answer the question, "How are your beliefs about teaching and learning related to your use of technology in your classroom?"

Therefore, the study design required that the research occur in three stages. In Stage 1, the researcher sought to understand and explain the beliefs of individual teachers regarding the roles of teacher and students in the instructional climate of the classroom. Through the use of a naturalistic inquiry strategy (see discussion, p. 73), participants were asked the question, "What are your beliefs

regarding the roles of the teacher within instruction and in relation to students?" Journal reflections of participants, classroom observations by the researcher, and emergent interviews, completed as suggested by naturalistic inquiry methods, were used to construct this understanding. In addition, the reflexive journal of the researcher, "a kind of diary in which the investigator, on a daily basis, or as needed, records a variety of information about *self* (hence the term "reflexive") and *method*" (Lincoln & Guba, 1985, p. 327), was used to record decisions, action, and influencing factors of relevance to the researcher as the study was occurring.

For Stage 2, the teacher and researcher then co-constructed a personalized plan of professional development that sought to support the teacher in achieving self-selected technology implementation goals. The plan was developed using a process from action research called an action experiment (see further information on p. 66). Serving as a resource person during this stage, I was available to the teachers to provide any type of technical training or resources needed for the participants to successfully implement their plan and integrate their knowledge into their instructional practice. Finally, the teacher was asked to evaluate the process by reflecting upon the success and appropriateness of the training, the professional development designed, and consider other uses for the knowledge and skills gained.

Documentation of changes, levels of satisfaction with the professional development process, and other relevant experiences of the process included participants' personal reflections, which were recorded on audiotape or noted in written form during the process, the researcher's reflexive journal and observation field notes, the co-constructed professional development plan, and a retrospective, emergent interview in which participants were asked to share comments about the process and about technology use in the classroom. All data were compiled and member-checked, a process of reviewing summarizations of participants' statements with participants at three points during the data generation (See p. 83 for a more specific discussion of member-checking.)

Stage 3 consists of a final set of interviews. Using emergent interviewing techniques, participants were asked to reflect upon relationships they perceived between their stated beliefs about teaching and learning and their use of technology in their classrooms. The use of emergent interviews, frequent member-checking, personal reflections of the participants, and the researcher's reflexive journal and observation field notes served as data generation procedures for this stage.

The study was conducted so that the findings satisfied the criteria suggested by Erlandson, Harris, Skipper and Allen (1993) as establishing trustworthiness, the "quality or goodness of qualitative inquiry" (Schwandt, 1997,

p. 164) and authenticity, the actions of the researcher that demonstrate commitment to standards for valuing “the separate realities that have been created by individuals, . . . the way these realities are responded to and the ways in which they enable individuals to respond productively to their environments” (p. 132).

RESEARCH QUALITY ISSUES

Assuring that the findings of the study are indeed trustworthy remains an outgrowth of demonstrating the quality of three components. First, is the research design consistent across the paradigm, perspective, and strategy chosen for this study as well as logical with regard to the stated anticipated outcomes? Secondly, were the procedures set out by the design conducted in a rigorous and careful manner to ensure that data generated, and analysis of that data, primarily reflect the voices of the participants regarding the study’s focus, rather than the researcher’s expectations and projections? And, thirdly, are the outcomes or findings set out in the research report written so as to also reflect a true depiction of participant perceptions?

The "goodness of qualitative research" as characterized by Peshkin (1993)—“a type of research that gets to the bottom of things, that dwells on complexity, and that brings us very close to the phenomena we seek to illuminate” (p. 28)—is demonstrated by the researcher through the meeting of certain criteria within the study’s design, procedures for data generation and analysis, and the

construction of the case study reports which present the study's findings. These criteria: credibility, confirmability, and transferability, provide assurance to the reader that the study has been conducted in a rigorous fashion and that therefore, the findings are trustworthy.

Credibility, or the ability of the reader to determine that the findings are a true depiction of the ideas co-constructed during data generation, was established by the use of several data generation procedures, e.g., member checking procedures (see p. 83), triangulation of multiple data sources and types of data (see p. 84), input from the researcher's peer debriefing team—a group of knowledgeable colleagues who review data generation, analysis, and reporting procedures (see p. 86-87), maintenance of a reflexive journal to record the researcher's decisions, thoughts, and insights (see p. 79-81), and prolonged engagement with and persistent observation of the phenomenon being studied and recorded in field notes (see samples in Appendix, p. 215). Documentation of each of these procedures was kept while this study was ongoing, and examples of such are included in the appendices.

Confirmability, or the ability to determine that the findings emerged from the data generated and the interpretations of the data originate primarily in the perspectives of the study participants rather than the expectations and projections of the researcher, is a criterion of trustworthiness that can be satisfied through the documentation of the "human instrument." Because the researcher's reflexive

journal documents her voice and records decisions made regarding the procedures, insights, and outside influences experienced during the course of the study, this document, as well as documentation of data generation and analysis, served this researcher as a means of creating confirmable results. (See sample of researcher's reflexive journal, p. 222, and sample of data analysis labels, categories, and themes, p. 226).

Transferability, or the applicability of the findings to other contexts and other individuals, remains the responsibility of the reader. However, within the construction of the case studies and themes, the researcher provided the reader with a carefully detailed description of the context, including detailed depictions of participants' beliefs and experiences and other relevant contextual factors, so that the reader is able to draw inferences applicable to other contexts, if any.

Even as trustworthiness deals with "*methods* that can ensure one has carried out the [research] process correctly" (Guba & Lincoln, 1989, p. 245 as cited in Manning, 1997, p. 94), an additional set of guidelines must be addressed that commit the researcher to "multiple realities," while "establishing a respectful and interactive researcher-repondent(s) relationships" and "negotiating a mutually constructed research product" (Manning, 1997, p. 95). These actions are recognized as satisfying conditions of authenticity when "separate realities that have been constructed by different individuals . . .[are] given status in the lives of

those individual, in the contexts in which they operate, and in reports of inquiry" (Erlandson et al., 1993, p. 151). Thus, the researcher must demonstrate that the following questions are answered.

First, is there evidence that the participants have had equal opportunities to voice their perceptions, and are these perceptions portrayed in the study report? Fairness, "the all-important task of striving to assure that various participants had an equal chance to express their voice during the research . . . with the goal of disclosing value systems and assumptions in an inclusive portrayal of the context" (Manning, 1997. p. 100-101), was demonstrated through the balanced solicitation and presentation of participant views with techniques such as gaining informed consent from the participants prior to study participation, the use of pseudonyms and direct quotes from participants, as well as the use of member-checking, peer debriefing, prolonged engagement, persistent observation, and use of participant and researcher reflexive journals.

Secondly, did the participants have the opportunity to gain insight and understanding about themselves as a result of participating in this study? This type of ontological authenticity was promoted through the use of "dialogical conversation," a process that Manning (1997) describes as:

> The respondent, safe and able to speak candidly, engages in a process where his or her meaning unfolds. The researcher is a collaborator in a dynamic process in which the respondent often comes to know his or her meaning in the process of saying it. In the creation of giving his or her meaning voice, that perspective is discovered and created" (p. 106).

Evidence of ontological authenticity is provided through the use of co-constructions as products—case studies, the statements of teaching philosophy, and the professional development plans—that are presented as closely as possible to the perceptions and stories of the participants, and through statements from participants that learning has occurred for them.

A third type of authenticity, which provides educative opportunities for the participants to grow in understanding about other participants as well as themselves, was provided in this study through member-checking and prolonged engagement with the researcher. As participants worked with the researcher to clarify and refine the researcher's interpretations of participant perceptions, a relationship of openness and confidentiality developed between researcher and participant. From this relationship, participants learned of procedures that other participants were using and sought out the other participants to ask questions, share experiences, and discuss how applications were being used in the classroom.

Catalytic authenticity, the ability of the participants to use the findings to make decisions about action, and tactical authenticity, the extent to which the participants are empowered to take action, were in evidence during the action experiment as the participants made decisions based upon their statement of beliefs and participated in training desired and selected by participants. In

addition, participants will be provided with copies of the finished study report. It remains to be seen how the participants will further use the study's findings.

The study's techniques were drawn from the methods of two strategies, action research and naturalistic inquiry, which furnished the data collection and generation procedures necessary to probe participant perceptions and provide individualized professional development in educational technology.

ACTION RESEARCH

Action research is described as a strategy used to "develop new skills or new approaches and to solve problems with direct application to the classroom or working world setting" (Isaac & Michael, 1997, p. 59). The strategy allows the participants and the researcher to work together "in all phases of planning, acting, observing, and reflecting" (Schwandt, 1997, p. 1). Action research was appropriate for this investigation of teacher beliefs and their expression in technology integration because the focus of the inquiry sought to examine the nature of technology integration when professional development was customized according to teachers' beliefs and practices of teaching.

Schwandt (1997) further describes the process of action research as a useful tool for changing conditions that improve "the situation in which a particular social practice takes place, the understanding practitioners have of their practice, the practice itself, or all of these" (p. 2). The participants in this study

were invited to plan, act, observe and reflect with the researcher on a weekly basis in order to share perceptions, insights, and questions. The one-on-one contact and guidance supplied by the researcher provided the nurturing and supportive environment necessary for participants to explore their own beliefs and knowledge needs. Each participant was aware that the problem solving to be conducted during the research inquiry would be done in accordance with his/her individual philosophy of teaching. In addition, the teacher's contributions were shaping ideas or solutions about training that would not only be important to the individual participant, but whose experiences may later prove useful to the local community of faculty members with which they work. By working together towards a common goal that strengthened the teacher's professional skills and revealed insights sought by the researcher, researcher and participant developed a special relationship that served as a motivational factor for participating in this particular study. So motivational has the participation in the action experiment proved, that the participants have requested that the researcher return to Corazon throughout the semester to continue the process by assisting the teachers in building upon the technical skills they acquired from the mini-lessons and mini-workshops to create more expansive projects.

The purpose of Stage 2 was to provide individual participants with technological training that supported their belief systems and teaching practices,

requiring the use of one method from action research called an "action experiment." An action experiment is a procedure in which the participants work with the researcher on an individual basis to define a problem or need, and then gather resources, prior research, and other information that is necessary for making informed decisions that address the problem or needs. Next, the participants construct a plan in which the situation is improved or problem solved, implement the constructed plan, and evaluate the progress of the program as it is implemented, making changes as necessary (Argyris, Putnam, & Smith, 1985). Greenwood and Levin (1998) further represent the procedure as:

> The professional researcher and the stakeholders define the problems to be examined, cogenerate relevant knowledge about them, learn and execute social research techniques, take actions, and interpret the results of the actions based on what they have learned (p. 4).

As Stringer (1996) further elaborates, the basic action research routine involves looking at the situation in which the "first task…requires participants to become familiar with the complexity that surrounds them" (p. 40) and "gather relevant information" to "build a picture (that) describes the situation" (p. 16). Next, the group "explore(s) and analyze(s) what is happening here," attempts to "interpret and explain how/why are things as they are" and finally, decides upon a plan of action that can be implemented and evaluated (Stringer, 1996, p. 16).

The researcher facilitated the following in order to create an atmosphere in which the participants were able to successfully conduct the action experiment:

Step 1: Define the problem or need

Argyris, et al., (1985) suggest that defining the problem or need may best be achieved by asking participants to compare and contrast their "espoused theory" of teaching beliefs, or the "theories an individual claims to follow" with their “theory in use” (Argyris et al., 1985, p. 82). From this juxtaposition of beliefs, participants should be able to describe a “need” for professional development. Thus, participants first were given opportunities to explore and gather data regarding their "espoused theory" of teaching beliefs, or the "theories an individual claims to follow" and how that relates to their “theory in use” (Argyris et al., 1985, p. 82). The activities included:

1) Data gathering activities, such as:

- Evaluation and classification of the types of instructional models participants routinely used, based upon their descriptions of their preferred activity structures given to the researcher during the Stage 1 description of their beliefs about teaching and learning.
- Discussion of overall teaching beliefs and reflection upon how these beliefs come through in teaching practices and instructional designs. Although the researcher was prepared to provide the participants access to a Teaching Styles Inventory (Grasha, 1996) or a self-report survey, such as the one conducted by the Teaching, Learning, and Computing staff (Becker et al., 1999, p. 2) should

the participants have had difficulty making connections between beliefs and practices, each of the participants in this study was most able to describe their respective teaching beliefs and how these beliefs were reflected in their instructional practices. Therefore, paper-based instruments were not used in this stage of the study.

- Discussion during which participants brainstormed possible technology applications of interest to them, how they were using technology presently within their instruction, how new technologies could be integrated and could support their instructional objectives, and how those technologies would support the participant's beliefs about teaching and learning.

2) Reflection activities, such as:

- Reflexive journal entries (see sample, p. 219) recorded each week in the form of "think aloud" or "stream of consciousness" reflections, either spoken into an audio tape recorder or written in a journal or on a note-card. Although the participants were asked to provide reflections twice a week in this form, a more realistic frequency became one spoken or written reflection per week.

- "Serendipitous" reflections (see sample, p. 218), or those informal discussions with researcher and/or other participants throughout the week. Because the researcher was on campus daily for a period of three months and was available during many casual moments during the day, many participants shared reflections as brief comments to the researcher as they were passing in the halls or eating lunch together. These reflections were captured in the same manner as field notes.

Step 2: Develop a plan of action and begin implementation

The particular nature of the following stages of the action experiment were determined by the needs each participant determined as crucial to their professional development as the action experiment continued. Due to the individual nature of each participant's professional development plan, the steps described below are only a general notion of the process used by the participants, with a more detailed individual accounting provided in the case study section of this document.

First, using the data/resources collected by the participant and researcher, and, with assistance from the researcher, each participant began to construct a personal plan of action for implementing a particular technology into their daily teaching practices based upon the methods that they felt would best suit their

students' current instructional needs, their own beliefs about learning and teaching, and their teaching practices. The professional development plan established the parameters of the training to be undertaken for the purposes of the action experiment for this study, and included decisions regarding what application would be utilized, what type of activity the participant would complete, and what skills would be learned.

Documentation of the implementation process was generated in the form of reflection activities, including:

- Reflexive journal entries recorded each week (described in the previous step)
- "Serendipitous" reflections, or those informal discussions with researcher and/or other participants (described in the previous step.)
- Informal e-mail messages to the researcher regarding information needs to be addressed at the next meeting.

Step 3: Evaluation

As evaluation in an action experiment is a formative process of feedback and adjustment (Argyris et al., 1985), it was essential that weekly meetings between researcher and participant occurred on a continuous basis in order to ensure that the participant's plan of action was evaluated each week, with problems identified and needed adjustments made. In addition, a final open-ended

emergent interview was conducted that allowed the participant to share reflections about the success, or lack of success, regarding their plan of action and its implementation. All interviews were audiotaped, transcribed, and member-checked.

The action experiment, encompassed a four-week session in order to provide the prolonged engagement and persistent observation essential to establishing credibility, or truth of representation of the informants' perceptions in the findings (Erlandson, Harris, Skipper, & Allen, 1993). In addition, the authenticity issue of fairness was carefully addressed during this phase of the study. The researcher was required to assure that "the process of fairly listening to and portraying voices" (Manning, 1997, p. 101) during the process in which the participants generated data, explored/analyzed, and planned/acted was presented in a fair and equitable manner.

NATURALISTIC INQUIRY

Although the action experiment supplied the venue for allowing teachers to blend their teaching practices with technology-enhanced activities that supported their beliefs about teaching and learning, Naturalistic Inquiry, the strategy chosen for Stages 1 and 3, provided the researcher with appropriate methods necessary to explore teachers' perceptions of technology-based activities deemed valuable to their teaching practices. Defined as a collection of methods with "the commitment to studying human action in some setting that is not

contrived, manipulated, or artificially fashioned by the inquirer" (Schwandt, 1997, p. 102), Naturalistic Inquiry relies upon a study design which allows the findings to "emerge" from the data as the value systems of the researcher and participants "interact in unpredictable ways to influence the outcome" (Lincoln & Guba, 1985, p. 41). Therefore, in order to document phenomena as they emerge, certain procedures for data generation and analysis consistent with the principles of Naturalistic Inquiry, as described by Lincoln and Guba (1985) and Erlandson, et al. (1993), were followed. These procedures:

- selection of a purposive sample (see p. 77-79)
- development of a "Researcher as Instrument" statement and maintenance of the researcher's Reflexive Journal (see p. 79-81)
- triangulation of multiple sources and types of data (see p. 84
- member checking (see p. 83)
- collection and analysis of data from which the working hypotheses emerge (see p. 85-87)
- preparation of case studies (see p. 87-89)
- work with peer debriefing teams (see p. 86-87)

are described in depth in the following sections and were used to insure the trustworthiness and authenticity of the findings.

The blending of methods from two different qualitative strategies, Naturalistic Inquiry and Action Research, in the construction of the design for this study was appropriate because both strategies placed the voices of the participants and the telling of their perceptions at the center of the inquiry, one of the assumptions key to constructing research in the constructivist paradigm.

The nature of reality in the constructivist paradigm recognizes that there are multiple realities that can be constructed by individuals; thus the context in which the participants constructed their perceptions and knowledge which were shared in this inquiry created a "working comprehension of the interrelationships that give definition to [the context]" (Erlandson et al., 1993, p. 14). Because there is no "one" reality, no two contexts will be alike, and therefore, full generalizations of the findings are not possible. Themes that emerge from the findings are products of the time and context in which the inquiry was conducted, and for that reason are bound only to this inquiry. However, through the use of thick description of context and participants' perspectives, the reader is presented with a "mosaic with general, unclear boundaries, but with rich central meanings" (p. 15) about the interrelationships that exist so that the reader can better understand the complexity of the situations, and use that understanding to draw what is relevant and useful to them in their own settings from this inquiry's findings.

Presenting the stories of the participants and their perspectives in context is only one component of quality constructivist research. The values that the participants bring to shared perceptions and any knowledge that is constructed from them are an integral part of the study. Likewise, the role of the researcher as "human instrument" or “primary data-gathering instrument” (Lincoln & Guba, 1985, p. 39) through which these perceptions and constructions of individual professional development plans are revealed must be acknowledged. In this paradigm, the researcher recognizes that it is impossible to separate the “knower from the known” and that reports constructed throughout the research are actually co-constructions between the perceptions and values of the participants and the perceptions and values of the researcher. The researcher is continuously involved in a process of interpreting these perceptions for the reader; thus objectivity as defined by the positivistic paradigm cannot be realized, nor is it desired. The researcher provides the context of the study’s focus, the perceptions of the participants, and the perceptions of the researcher; thus permitting the reader to “hear” the voices of the participants as truly as possible. The procedures described below: the careful selection of a purposive sample, the writing of a "Researcher as Instrument" statement as a precursor to data generation, the use of naturalistic methods for data generation, the use of emergent design for data analysis, and the use of case study reporting, are components necessary for such a constructivist research design.

PURPOSIVE SAMPLE

The use of purposive sampling to "maximize discovery of the heterogeneous patterns and problems that occur in the particular context under study" (Erlandson et al., 1993, p. 82) is one aspect of this phenomenologically based inquiry. Possibilities for information richness were provided by selecting participants for the study who "will most help to answer the basic research questions and fit the basic purpose of the study" (p. 83) and bring a diversity of backgrounds, perceptions, and experiences to the discovery process.

Therefore, in order to provide as much diversity as possible within the purposive sample, participants were recruited from teachers in an urban area of Texas. These recruits were chosen from schools with adequate student access to the technology, as indicated by the presence of one or more computers within each of the participating classrooms and similar technology access provided to the teachers. In addition, participants in this study were chosen from among teachers who possessed a basic level of competency with computer-based technology and expressed an interest in learning to use these technologies regularly within their daily classroom instruction, but who were searching for ways to accomplish this.

These parameters were established so that the perceptions of participants with similar technology training backgrounds and technology support could be explored. The sampling was designed to include a broad variety of informant experiences based on gender, unique teaching situations, a variety of technology

access, a variety of teaching expertise (novice vs. experienced teachers), and various experiences teaching at different elementary grade levels. Thus, the eight participants chosen for this study were chosen from the same elementary school, Corazon Elementary School, and represented all the grade levels, as well as a diversity of age, gender, and teaching experience. More specifically, the participants consisted of two males and six females, with teaching experience that varied from three to thirty-four years of teaching and ages ranging from the mid-twenties to early fifties. In addition, the sample consisted of two third grade teachers and one teacher from all the other grade levels, Pre-K through 5. An additional male third grade teacher was persuaded to participate in order to insure as much gender diversity as possible. While data were being generated, the first grade participant withdrew due to personal reasons, and later resigned from teaching at the school. The resulting sample consisted of seven participants: three teachers representing the primary perspectives (one Pre-K, one K and one 2nd grade teacher) and four teachers representing intermediate perspectives (two 3rd grade, one 4th grade, and one 5th grade teacher).

The provision of a diverse sampling of sources to inform the research process is designed to provide the reader with an information-rich context in which to consider study findings. According to Lincoln and Guba, (1989, as cited in Erlandson, et al., 1993) "in a naturalistic study, the obligation for

demonstrating transferability, (or the applicability of the findings to other contexts and other individuals), belongs to those who would apply it to the receiving context" (p. 33). The diversity of information is provided as a means of permitting the reader ample opportunities to infer similarities between their professional milieu and the situations described in the study's findings.

RESEARCHER AS INSTRUMENT

According to Lincoln and Guba (1985), a naturalistic inquiry "*demands* a human instrument" that will "build upon his or her tacit knowledge" (p. 187). The human instrument is "value-based" and interacts with values of others in order to "identify and take into account (to some extent) those resulting biases" (p. 40). Because the researcher serves as the instrument through which the data are generated, analyzed, and filtered to the reader, Erlandson, et al. acknowledge that "a record needs to be kept on the primary human instrument that is being used in the naturalistic study" (p. 108) so that the reader has the opportunity to review the values and perceptions of the researcher and determine what influences they may have had upon the research findings.

In order to establish the values and preconceptions that I, the researcher, brought to this study, I prepared a "Researcher as Instrument" statement before embarking upon the process (See Appendices, p. 194). Within this statement, I attempted to inform the reader of the values and perceptions that I held during

data generation and analysis, as well as the experiences that have molded those perceptions and values regarding the topic of this study: teachers' beliefs and their relationships to technology-related activities teachers deem valuable to their instructional practices. The statement described my teaching experiences, as well as my experiences as a parent, that have impacted my beliefs about the power of the computer to motivate and stimulate learning for our children. I also addressed the belief that drives my own personal exploration into this topic of study—that teaching teachers how to use the tools within their personal teaching practices may be more important to "getting the tools in the hands of the students" than making the teachers skilled in the operation of the tools themselves, which was defined in Chapter Two as "technologically competent" (Lowther et al., 1998).

A second form of documentation, the reflexive journal, was included, as per suggestions from Erlandson, et al. (1993). The reflexive journal served as my record of insights regarding my reflective thought processes throughout the entire research process. Entries from the journal recorded decisions I made throughout the research process, reflections upon new information or readings which served to influence my thinking, strategies for working with informants, and difficulties within the research process; as such, they form a chronology of the research study. (See sample of reflexive journal entries in Appendix, p. 222.)

In addition, participant reflexive journals in the form of "think aloud" entries were recorded, either as audiotaped or written journal entries. Throughout data generation and analysis, the participants recorded these journals at least once a week, and summaries of “serendipitous conversations,” or participant reflections shared with the researcher in informal settings, were recorded in a fashion similar to observation field notes (See sample of participant reflexive journal entries in Appendix, p. 219-220 and samples of serendipitous conversations, p. 218). These taped and summarized entries were maintained as a means of documenting the insights, thought processes, and feelings experienced by the participants as they made decisions, developed strategies, made changes in their teaching practices, and thought reflectively throughout the research process.

These three tools not only served as ways to keep the researcher focused upon the individuals and their values brought to the study, but also supported the trustworthiness of the study by providing a means of establishing credibility, confirmability, and dependability, and authenticity by demonstrating fairness. These components of quality research are further described in the section that details research quality issues (see p. 61).

DATA GENERATION

Data generation for the purposes of this study occurred during the Fall 2000 semester, first using naturalistic inquiry methods through an unstructured,

open-ended, emergent interviewing process conducted with the seven informants described in the purposive sample. The interviews were scheduled weekly, and were tape-recorded, transcribed, and member-checked (a process described below, p. 83) through follow-up interviews with the participants. Summaries of serendipitous conversations held with the participants during informal meetings and classroom observations were member-checked at the same time.

The emergent interviewing process was conducted with all participants individually in the study. During the first stage of the research, the purpose of the emergent interview process was for the researcher and each participant to co-construct a statement of teaching philosophy that reflected the individual participant's perceptions of learning and teaching in the classroom as well as the roles of the teacher and students in the learning process. This process was characterized by an open-ended interview situation that was initiated through a single question. The interview process began with: "What are your beliefs regarding the roles of the teacher within instruction and in relation to the students?"

During the ensuing dialogue, the researcher continuously sought to understand the meanings of participants' perceptions by using two processes. First, the researcher sought clarification through follow up questions that asked the participant to elaborate and expand upon the content of previous responses.

Secondly, the researcher used a process called "member checking." Member checking refers to the researcher "soliciting feedback from respondents on the inquirer's findings" (Schwandt, 1997, p. 88) through the process of reviewing summarizations of participants' statements with participants at three points in the data generation process. First, the researcher's understanding is checked with the participant during each of the interviews. (See sample of Level 1 member checking, Appendix, p. 200). After the interview, the researcher reviews all data generated, and forms a written summarization of the information the participant offered. Level 2 member checking occurs when these perceptions are revealed to the informant, who then clarifies and refines these perceptions for the researcher. (See sample of Level 2 member checking, Appendix, p. 208). The participant is given a third chance to review and correct the researcher's analysis of the data at the conclusion of data generation by reading and responding to applicable study findings generated from the data that participants contributed to the study. (See sample of Level 3 member checking, Appendix, p. 212.)

Emergent interviewing was also a key component of data generation during Stage 3 of the study. At this time, the interview process began with the following open-ended interview question: "How are your beliefs about teaching and learning related to your use of technology in the classroom?" Again, all interview data were member-checked on three levels in order to ensure that the

constructions resulting from the interviews reflect primarily the perceptions of the participants. Careful attention to the process of member checking was necessary so that, even though the findings that emerged from this study were co-constructions between researcher and informant, the voices of the participants were truly recognized and represented in the findings. Thus, the data and the interpretations that result from them are confirmed as primarily reflections of the participants' perspectives, rather than the researcher's expectations.

Other data in the forms of related documents, such as e-mail conversations with informants and reflexive journals written by researcher and participants, were also collected and considered during data analysis. (See samples, Appendix, p. 219-220). Additional documents, such as the field notes generated during classroom observations and "serendipitous conversations," were also generated and analyzed. (See sample of field notes, Appendix, p. 215.)

Through the use of multiple sources and multiple methods of data generation, this study addressed the need to attain "triangulation of multiple data sources, methods, investigators, or theories" to provide greater "confidence in the observed findings" (Erlandson et al., 1993, p. 139). Triangulation is one of the techniques used to ensure that the study has been conducted in a rigorous and trustworthy manner revealing as much complexity about the phenomena explored as possible.

DATA ANALYSIS

Data analysis in a study that uses naturalistic inquiry and action research is inseparable from data generation and collection. Erlandson, et al. (1993) state that "in the collection and analysis of data, it is sometimes hard to distinguish between when the collecting ends and when the analysis begins, for gathering and analysis are complementary, ongoing, and often simultaneous processes" (p. 85). Because the researcher serves as the human instrument through which data generation and analysis flow, the process of data analysis began with the first contact between researcher and participant. Data generated from each contact with participants, through interview, observation, or the creation or review of documents, helped to form several tentative findings, which led the researcher to probe some areas of discussion more deeply or change strategies for observation and data generation. This process of adjusting data generation procedures continued as additional data were generated and tested against the evolving themes. Thus, the actual procedures of data analysis began with the tape-recording and transcription of the first interview, which then underwent an analysis process that involved three steps:

1. The text was broken into small segments that each represented an independent thought about the research focus. These smaller segments were coded with labels that the researcher determined were descriptors of the thoughts contained within the segments. This process is called “unitizing the data.”

2. The researcher then determined a categorization scheme, which emerged from sorting the unitized data into related categories.
3. As similar categories were grouped together and the researcher discovered their relationships with each other, themes, defined as "general statements applicable to the specific context under investigation" (Erlandson et al., 1993, p. 61), emerged.

As new interviews, documents, and artifacts were generated, their text was unitized, and the new unitizations were compared with the current categories and themes. Adjustments in categories and themes were made to accommodate the emerging themes. The process of generating data, unitizing data, and developing categories and themes from the data continued until reaching thematic saturation, or the point at which no more new categories and themes made themselves apparent (Erlandson et al., 1993).

To further assure credibility and confirmability of the findings of the study, a peer debriefing team was utilized to review data samples, test samples of data analysis against emerging themes, and generally provide a sounding board for the researcher's ideas, questions, and conclusions. The peer debriefing team was composed of four colleagues with whom I share a bond of trust and confidentiality. Not only have we worked together on a weekly basis for some time, but also each of us has participated as the researcher in a research study that

utilizes naturalistic inquiry or case study methods. Thus, these colleagues were knowledgeable about the details and the procedures of the research being undertaken in this study and shared a level of expertise within the discipline of education. The peer debriefing team met on a weekly basis to review data, data generation techniques, revise coding procedures, confirm or disconfirm emergent themes and working hypotheses as logical and proper, and provide final editing suggestions.

CASE STUDIES

Once data generation and analysis were complete, presenting the results so that readers are able to discern components of the research findings that might be transferred to their own professional contexts became a matter of recording "the circumstances, meanings, intentions, strategies, motivations, and so on that characterize a particular episode" (Schwandt, 1997, p. 161). This is usually done by providing a thick, rich description of the phenomena encountered in the process of research. The naturalistic inquirer and action researcher use case study format as the vehicle for providing this thick description, which allows the reader to judge the information held within the case study and make decisions whether or not the themes that emerge can be transferred to their own situations. Therefore, the cases included in this study's results are reports constructed with the help of the participants. They are meant to depict the experiences, perceptions, and beliefs

that these seven teachers held regarding the influence of their beliefs upon the technology-related events that they have experienced and that they deem valuable to their daily classroom instruction.

As professionals who have completed the district's technology competency training, the participating teachers shared common technology training backgrounds, but had experienced a variety of teaching situations with differing levels of access to technology, which varied according to the ages of the elementary students with whom they are working. Indeed, the case studies constructed during this study represent the perceptions and experiences of these elementary teachers that are related to their integration of technologically-based lessons into their daily instructional practices. In addition to providing the reader with detailed, thick descriptions of the experiences lived by each of the study participants, the case studies are constructed so that the common themes which emerged from data generation have been made evident within the individual case study reports.

Two further considerations were given to the construction of the case studies. First, as the researcher was a guest "in the private spaces of the world" of the participants (Stake, 1994, p. 244), special attention was given to protecting the confidentiality of the participants throughout the case study reporting. Secondly, in order to satisfy the criteria of fairness necessary to provide authenticity and

confirmability for the study (Lincoln & Guba, 1985), every effort was made to ensure that the case studies primarily represent the voices and the perspectives of the participants, rather than those of the researcher. The use of member-checking provided one means of accurate representation of participant views offered during interviews, reflexive journal entries, observations, as well as those portrayed in documents and artifacts. Review by peer debriefing team members during the construction of the case studies from the data provided another means of keeping the researcher true to the voices of the participants. And, a researcher's reflexive journal that recorded the thought processes, decisions made, and other factors influencing the construction of the case studies was carefully maintained.

Implications

The purpose of this inquiry was not to formulate generalizations that will be true from situation to situation, but to "illuminate a particular context and provide working hypotheses for the investigation of others" [Erlandson, 1993 #1, p. 45]. By providing thick description of the perceptions, values, and situations experienced by the seven teachers who served as participants in the study, I have endeavored to describe the factors and common threads that emerged as unique to this phenomenological focus. To assure readers that the themes emerging from data generation and analysis procedures were indeed constructed so as to meet the

criteria for establishing trustworthiness, specific data generation and analysis procedures were followed and documented, with samples of such placed in the Appendix.

CHAPTER 4

Erlandson, et al. (1993) propose that within a naturalistic study the "principal task of the researcher is to communicate a setting with its complex interrelationships and multiple realities to the intended audience in a way that enables and requires that audiences interact cognitively and emotionally with the setting" (p. 163). Case studies are used by the naturalistic inquirer as one of the tools to present the reader with a description of interrelationships within the phenomena under study, as well as a thick description of the context in which the phenomena occurred, allowing the reader to judge the information held within the case study and make decisions whether or not the themes that emerge can be transferred to their own situations. Therefore, the case studies that follow are reports constructed with the help of the participants, and they are meant to depict the notions that the seven teachers held at the time the study was conducted regarding their beliefs about teaching and learning, the process of developing technology-enhanced instruction and acquiring the skills to construct those activities, and how their teaching beliefs are related to their use of technology enhanced instruction.

Setting

Corazon Elementary[1], located in the northeastern portion of a thriving southern metropolis, opened its doors to a population of over 500 students (ethnic breakdown: 42% African American, 40% Hispanic, 18% Anglo; 85% economically disadvantaged) in the fall of 1998[2]. The principal hired staff committed to completing their district technology certification during this first year of operation, worked with the campus curriculum director to secure grants for outside training and acquisition of hardware and software for classroom technology use, and secured a technology specialist for on-campus technical assistance and professional development. Throughout the first two years, faculty attended training sessions conducted not only by the on-campus technology specialist, but also by a regional educational development laboratory whose services provided continuing enhancement or updating of skills throughout the year. Teachers were encouraged to share, mentor, and work together to solve technical problems and develop instructional activities that could be infused into the curriculum. In addition, computers were distributed to the classrooms as access to them became available, with each classroom having from one to four computers available for teacher and student use. A school-wide computer lab with

[1] Pseudonyms have been substituted for names of individuals, schools, cities, and other identifiable characteristics.

[2] Current figures for 2000-2001 are 630 students, 37% African American, 52% Hispanic, 22% Anglo and other and 84% economically disadvantaged.

projection device became available for teacher/student use in the spring of 1999, but the explosion of the school population during 1999-2000 and the 2000-2001 school years necessitated the use of computer lab space for classrooms. Lab computers were dispersed to individual classrooms, resulting in a each classroom having between three and four computers.

With a teaching environment that addressed many of the barriers to technology integration identified by research (i.e., at least one computer in the teacher's classroom, on-campus technical support, administrative commitment to the goal of technology integration, training that provided technical skills and modeling of use of technologies within the classroom, and a school-wide community of mentorship and sharing (Becker, 1994; Hadley & Sheingold, 1993), Corazon Elementary serves the local school district as a model for a technology-rich educational environment, and as such, became the ideal situation for an exploratory investigation of what teachers perceive as valuable in a teacher's process of becoming "technologically competent."

Corazon Elementary School also serves the district as the model in two other areas. First, the school has made progress in preparing its students to pass the state examination, Texas Assessment of Academic Skills (or TAAS), given to students at each grade level beginning at Grade 3. The school does this by monitoring each student’s skill acquisition based on the Texas Essential Knowledge and Skills (or TEKS), state mandated learning objectives per grade

level and content area that comprise the core content of the exam. Through a school wide alignment of the TEKS, the teachers use these objectives as a basis for planning their weekly instruction in Reading, Math, and Writing, and express the idea that these techniques have helped them prepare their students for academic success.

A second program being modeled at Corazon Elementary School this year is called the *Principles of Learning*, an effort-based, content-oriented approach to thinking about learning and teaching based on the research of the Institute of Learning, University of Pittsburgh (Institute of Learning, 1999). Because the teachers at Corazon Elementary have done such an excellent job of integrating the *Principles of Learning* into their instructional practices, administrators and teachers from other district schools regularly walk through the classrooms, visiting with students and teachers.

Case Study Reports

As the study was conducted in three stages, participants were asked to reflect upon perceptions that were relevant to each particular stage, and the case studies were constructed to reflect these topics: Stage 1—Personal beliefs about learning and teaching, Stage 2—Professional development process, and Stage 3—Relationships between beliefs and technology use in instruction.

Furthermore, as employees of Corazon Elementary School, the

participating teachers share common technology training backgrounds, but have varying amounts of teaching experience, work within classroom situations with varying amounts of technology access, and work with different student age groups. The case study reports that follow are designed to represent the voices of these participants.

THE LITERACY SHERPA

Personal beliefs about learning and teaching

The computer has got to be the biggest hook we have for getting [students'] attention . . . they'd rather do that than anything in the world. It's a game. They think it's fun. —Debbie Haley, Pre-K Teacher

On this particular day, the children in Mrs. Haley's Pre-K classroom are "partner reading" along with the words they hear as the tape player "reads" the story to the children. One child is in charge of the pointer and "points" to the words as the tape reads them aloud, and the other partner is in charge of turning the page when the tape beeps to indicate a page turn. Debbie is modeling the correct "pointing" with her own pointer and big book in front of the class. Together they listen to the story and practice their skills. This activity is just one of the many opportunities Debbie uses to teach "procedures, procedures, procedures." When explaining that the world of Pre-K is all about providing an educational environment in which the students learn societal boundaries and "modified-down" life skills, Debbie expresses her belief that her role as teacher

includes providing the support in two very important areas. Much as the sherpas of Tibet guide outsiders through unfamiliar terrain, helping them learn the survival rules and skills for successful journeys in an unknown land, Debbie feels that teaching students the rules and processes necessary for the more academic environment of Kindergarten is a top priority:

> The kids that I have qualify [for the Pre-K program] because of low income. For many families, the parents appear to have problems functioning within societal boundaries, for example, getting to work or school on time or at all,. . . so the first thing the kids have to learn is that there are boundaries, rules that are most important that you follow them. You have to do what the teacher and the school say you have to do.

Debbie believes that all students can learn these behaviors through "modeling for [the students]" and "role-playing the appropriate way to do things." As a result, many of the activities that Debbie uses with her students involve consistent reinforcement of procedures so that they will develop "the ability to listen and cooperate and work in a group," those skills Debbie feels are essential for academic success in Kindergarten and basic life skills. She comments further, "If that's all they get from Pre-K, we'd be happy."

Debbie also believes that the role of the teacher is to provide a second component to the educational environment, "exposure to lots of literature, lots of language." Supporting the acquisition of literacy skills and language development is especially critical for Debbie's students because they "don't get the exposure

[to literature, books, and language at home] that [students] get in a higher socioeconomic group." Debbie explains that when she asked her students to bring a book to school, "at least a third of [the] class didn't own a book they could bring in their backpacks to read in the cafeteria." Accordingly, Debbie provides her students with continuous opportunities to "read books, charts, poems, and create class and personal books, which we use to talk about things" and "discuss an idea and expand upon an idea. Everything we do is talk, talk, talk, talk, talk."

Inclusion of activities that allow the children to talk to the whole group or with small groups or with a partner is the keystone for the structures Debbie uses in her classroom. The room is set up with a multitude of centers: math manipulatives and small toys, puzzles, blocks, dollhouse, writing and art, housekeeping, poetry, library, and computer centers. Debbie uses the centers as catalysts for discussion. For example:

> [the] dollhouse is always out. That's a lot of talking about family and what people do in a house and family . . . like when we do our ocean unit, you can hear them over there talking about, "Let's go get in the boat and go fishing and go catch some octopus" . . . when you throw those words out there, they just figure out a way to use them everywhere.

Debbie believes that the key to creating an educational environment that allows her to support her students in their quest to develop the societal behavior and the language and literacy skills needed to promote learning is to provide activities that are fun and non-threatening. Spoken like a real sherpa who

encourages and motivates participation in the journey, Debbie explains, “If they're not scared, they're going to produce. If they're scared that they're going to do it wrong, they are not going to do it. They are not even going to try.” Much of her instruction uses a process of modeling the desired behavior or skill with the group and then allowing the students time to try the activity on their own. For example, writing activities are usually a form of story response. Debbie describes the process as:

> I read the story. We get in a circle. And each person tells what his or her favorite thing was about the story. Then they go to the table and write it. And I'll model it before they go to the table. I'll actually draw the picture. Okay. "My favorite part of the story was when Sally was upside down. So what would I draw?" And then I actually draw Sally and model. "Okay. The first thing I'm going to draw is her head. What shape is her head?" Because they don't know how to draw. They can't go to a table and draw a picture, because they haven't figured out that it has to have all the parts. So we talk through as I actually draw, so they can see, "Oh, that's how you draw. You think of the shape." And model that, and then I'll go down at the bottom and actually write my sentence, and go through the sounds. So they see me figuring out, "Okay. Sally. S, Sally." And I'll write the 'S' and model that way, and it's amazing. If you don't tell them that they have to do that, how much faster they do it than if you tell them they have to try it, because it's non-threatening.

Professional development process

Debbie personally uses technology a great deal. There are samples of her use throughout her classroom. Pictures of her students taken with the digital camera illustrate the principles that the class has set out as essential components of quality work on the Good Work charts about the room. Name recognition cards used to take attendance are graced with student pictures also. A “Word Wall,” a

display where the students place words they are learning to spell, and other printed charts cover the walls in her classroom. Debbie also word processes a weekly newsletter designed to inform her students' parents about the work they are doing in class and make suggestions as to how parents might work with their children at home.

Within her instruction, Debbie incorporates technology into activities, either as the formal planned activity or informally as a resource for student questions. As student interest drives much of the exploration and discovery in the Pre-K classroom setting, having access to a resource that allows instant information has been invaluable. On the day that the children found the ladybugs that had hatched in the butterfly tank, Debbie was able to locate resources on the Internet that presented color pictures of the insects that described all the parts so the student could draw their own pictures. Their search also turned up an interactive, online game the children could play, as well as a ladybug "nursery rhyme [in which the class] changed the words and wrote our own based on the one we found on the Internet." Debbie further elaborates on this point by adding:

> The teaching activities you do need to be fun and they need to be exciting…. Basically our [Pre-K] program is all language development, so if your lesson plans say you're supposed to talk about friends this week, and you find caterpillars, you shift gears, because you talk and you teach about what the kids are excited about. Pre-K [and] early childhood should be interest-driven, not TEKS-driven.

In addition to using the computer as a resource in her classroom, Debbie employs the formal act of using computer software as a planned activity to supplement her thematic units. The process Debbie uses to introduce a new computer game or other piece of software reinforces this atmosphere of free exploration without penalty. First, Debbie pulls the children together as a group in front of the computer that is hooked up to the television. Together, the whole group works through the new game. When Debbie feels that the group has learned the basic operational procedures (which could take one day of playing the game or may require several rounds of practice), she allows individuals to operate the game while the group tells the "operator" what to do. When students have mastered this phase, she places the software in the computer center for small group play for those who still need support to play the game or for individuals who are able to play the game independently. The process of introducing a new skill, modeling its use, and allowing students to practice and incorporate new skills at their own pace is one of the basic teaching structures that Debbie uses.

When asked what type of technology-enhanced activity she would be interested in putting into practice in her classroom, Debbie described her need to be able to create multimedia activities that could support her thematic curriculum units for which she has no commercially-available software. She had seen some of the HyperStudio stacks that the Kindergarten teachers used and felt that she

could develop the same to support her curricular needs. Although she had passed the HyperStudio competency required by the district, she feels she needs to further develop her own technical skills with the application to carry out the project.

Therefore, the professional development plan associated with this study was designed to provide Debbie with the advanced HyperStudio skills needed to create a "Community Helpers" stack using the application. Serving as the resource person, I created a template that reviewed the basic operational procedures of HyperStudio and provided Debbie with an environment in which she could work with the more advanced capabilities of the application. Debbie's completed stack was to be placed in the computer center for student use.

While evaluating her experience, Debbie commented that the process of the action experiment (brainstorming, planning, acting, and evaluating) was valuable to her because it gave her the extra incentive to work on the project.

> I know enough about the program to know that it's flexible enough to create any kind of activity I want. I just haven't had enough time to work with it to figure out how to do that . . .I need some accountability like [the resource person] to make me do it.

In addition, the one-on-one training was valuable to Debbie because she had someone to scaffold her learning process as she worked through the project. For example, Debbie wished to include animations and other new button actions that she had seen enabled in other HyperStudio stacks into the one she was

creating for her students, and felt that having access to the resource person while she was acquiring these skills provided her with just the type of training she needed when it was needed.

Debbie also felt that using the resource person as a source of information about how certain multimedia effects could be created with HyperStudio helped her visualize ways to improve her creations. After reviewing the project that she had created so far, she expressed a desire to use a more open-ended approach in the design of the stacks. Incorporating a question into the activity increased the interactivity of the product, a component that Debbie felt was essential to a quality product the students should be using. For example, in Debbie's view, when the students are asked to answer a question such as "Which of the following does a fisherman use?" by clicking upon the appropriate response, enabling the stack to give appropriate feedback such as "No, the baker uses that. No, a plumber uses that" provides a better learning environment and is a stronger teaching tool. By brainstorming with the resource person, Debbie was able to determine a method for increasing the interactivity of the product design that will allow her to design stacks that incorporate this feedback component that she often finds lacking in commercially produced software.

Relationship between beliefs and technology use in instruction

One of the "best things the computer does," Debbie claims, "[is] expand vocabulary." She supplements the students' Ocean unit with *Freddy Fish*, a commercial product that she introduces to the children in a whole-group activity and then places in the computer center for individual and small group use, because the software uses vocabulary naming "all the different things in the ocean. There's a fiddler crab character, an octopus character, and a squid character." For other units, such as the farm unit, she uses software that highlights vocabulary that supports conversations about farm animals. She just recently found a CD-ROM that incorporates caterpillars, moths, butterflies, beetles, crickets, grasshoppers, and fireflies into a story format and several games, and was excited that "after about five minutes, [she heard from the children,] "Don't click there! That's a spotted moth. That's not a ladybug."

A second reason Debbie gives for incorporating technology into her instruction is that it supports her desire to explore topics in which the students express an interest. Debbie sums up her thoughts this way:

> I believe what the research says about early childhood—that your lesson plan shouldn't be done two weeks ahead. They should be done one day at a time. What were the kids interested in that day? Which way do we drive [instruction]? There are some skills like counting and ABC stuff that you need to do, but you can throw that in with anything you're using. So using the computer helps me find more resources based on what they are interested in, because I have a theme box for everything for the month, but if they come in and want to talk about racecars, we talk about racecars;

> and if I don't have anything about racecars, we go research on the Internet or play a game that's got racecars on it.

Debbie also uses technology because it presents information in a fun manner that is completely free of the "fear factor," which Debbie interprets as the students' fear "to try something and be in trouble because they didn't do it right. Their fear level is very high." And, she adds, "I could stand up there and drill, drill, drill. This is a fish. This is a tree. This is a whatever. But when they go to the computer, they get it in a fun, non-threatening way."

Finally, Debbie uses technology to support her belief that part of her role as teacher is to help her students learn the procedures necessary for success in kindergarten. Because she has certain students that would spend all of their center time in front of the computer rather than visiting the educational opportunities in the other centers, Debbie occasionally has to close the computer center for a day. "Taking part in the activities in all the centers is [the students'] work" and, therefore, Debbie reinforces the concept for her students that success in school involves working on all activities, not just the activities that are favorites.

THE GARDENER

Personal beliefs about learning and teaching

There are some kids that are ready to learn and open up and can get the reading really quick, and then some kids will take a little while to [learn this skill]. It's like

a rosebud in a rosebush, I guess. With the right conditions and elements, they will open up and become roses in full bloom. Not all will bloom at the same time, so we need to continue to feed them the skills. They will open at their own time. Because they don't all get it at the same time, it doesn't mean that they failed to open. —Martha Stewart, Kindergarten Teacher

For Martha Stewart, Kindergarten teacher, teaching is all about seeking the best "educational recipe" that works for each child in such a way as to stimulate growth as an individual and a learner. Reminiscent of the techniques a good gardener uses to provide the right kind of soil, sunlight, plant food, and water for each individual plant in order to achieve maximum growth and health for the plant, Martha states, "I like to get from here [takes a pinch from the air], from here [takes another pinch from the other side], put all the ingredients in, then work with it." Martha smiles as she continues, "You just can't use milk and come out with a great product. You've got [to add] a little cinnamon, a little nutmeg."

Further evidence of Martha's belief that her role is to "grow" students who prosper and succeed is a table in the center of her classroom filled with school pictures, high school graduation pictures, and sport pictures of former students. She adds, "I'm tracking my kids. I'm keeping up with them. Every time I see them anywhere, I'll say, "Hey, where are you? Have you changed your phone number?" Because I want to see how far they get."

Martha states that good teaching requires the understanding that each learner experiences the learning process differently, so the role of the teacher is to

enjoy “the differences in each child, . . . learn from that, and teach each child individually.” For Martha this means that her instruction must:

> take the child from the level he comes in and build him up. Like, I’ll have a child that doesn’t know how to write his name or doesn’t know his numbers. So I have to start from scratch, teaching him how to do strokes, and then getting him into numbers, and then getting him to count different things, and trying to associate that the numbers mean something with concrete objects . . . start with what they know and build up.

When queried further about what this might look like in her classroom, Martha explains that while the children are actively exploring the learning centers stationed in her room, she pulls a group of four or so students over to a table for instruction. For reading, she may have “a reading group [where] she will have letters to find out what letters they know,” so before long she has discovered that “there will be groups who know how to read one word or something like that. Then, I’ll know what books to give each child or what instruction to give each child.” She makes the point that she must individualize for the child because

> it doesn’t matter how the process begins, because each child will learn the process differently. Some kids will learn by knowing the alphabet and then the sound. Some kids will learn it in order and some kids won’t. Some kids will pick up big chunks. They’ll pick up “see” and “end” and “cat” because they are doing some visual work. Some kids connect sign and sound.

Another ingredient for individualization includes providing opportunities for students to engage in free exploration of resources. The children are allowed the freedom to choose centers, activities, and resources with which to explore during center time. Martha believes that this process “allows the child to think

freely, instead of think conformity" which leads to the development of creativity in the individual. "I think everybody has a creative gift," which is often suppressed "because they were taught to do so, because no importance was placed on that creativity."

One needs only walk into Martha's room to see this individualization in action. Her classroom is arranged in a wide array of centers. The Reading Center is set up like a stage that says, "Learning is Fun," with books, big books, and animals just right to hold while reading in the rockers. The Math Zone has puzzles and the "problem of the day" set up. The Computer Center holds three computers with games and activities that support the current thematic study. The Science Center holds a stethoscope and a take-apart figure of the human body. Stations for listening, exploring globes, building with blocks, creating with clay, writing in journals or drawing pictures, and playing house fill the room with colorful objects that students find useful for play, investigation, and exploration.

Martha allows the students to work in any of the centers they choose, and they may work with whomever they please. When dismissed to centers, the students quietly spread to the center of their choice. Six children work at the computers with two using a HyperStudio stack, two creating a drawing in KidPix, and two playing a game of Reader Rabbit. Other students are creating clay animals in the art center, and several students have taken out the dollhouses and

are playing with action figures. Two students finish at the Art Center, clean up every scrap of clay and place the jars back neatly in the center. They move over to the Science center, where one places the stethoscope around his neck and together, they investigate the jars of body parts and the way the stethoscope works. Martha pulls four of the students to her table and they work on creating their own booklet of animals, the thematic topic for the week. First, the students practice tracing one animal to the page. Then, they each work to write the name of the animal on the page. Martha's aide works with a group of four as they write their name in a sentence about an animal on a large sheet of paper. The children are actively engaged in learning tasks that supports their needs and interests.

Martha's recipe for "gardener's mix" that ensures successful learners includes not only individualization of instruction to match each student's learning needs, but also includes a pinch of encouragement for creative thinking and expression. "I like for them to think in different ways, not just to process what's there, but to process what's not there." She further clarifies this point by explaining that she tells the children she's going to trick them with a math problem, so she gives them the problem in many different forms. The students have to listen and "then they notice that I'm tricky, so they start figuring out different ways to count things . . . they feel like it's a game that I'm playing with them. And, they try to outdo the teacher after a while." Often, she will include

activities in her instruction that "challenge my students to think, again, beyond the box, to try and prove things, to come up with their own theories and their own conclusions." She illustrates this point with a story about a Science activity that presents the story about a professor who studies dinosaurs. In the story,

> dinosaur footprints are found at the top of the mountain. Dinosaurs are not known for climbing, so how did the footprints get up there? I asked them to give me their theories. I put them all down . . . then we talked about plate tectonics [and I showed them] what happens when continents collide. I gave them two pieces of construction paper, and they were paired up. And they showed me what happens when the plates collide.

One of Martha's students, who at the time was having great difficulty in reading and math, was the only one to solve the problem, even before she had read the explanation at the end of the book which tells how the footprints got to the top of the mountain. Martha finishes the story by saying,

> Now, if that child could figure that out and nobody else could, you know he's got a really pretty good mind . . . I was like, "Awesome!" And, [the child] was so proud of himself, because that [was]n't an easy question.

One sees a further comparison of Martha to a garden guru in that, to Martha, good teaching means "growing" a learner who feels confident by "looking at the stuff, even the smallest thing, that's positive, and [building] on that. When you build on that, you have success." Martha sees her responsibility as a teacher in "growing" this successful learner as helping students feel good about themselves, which can be done in two ways. First, good teachers provide their students with "lots of praise." She elaborates further,

> Whenever my kids answer a question very well, I'll always use very strong words like . . . "You're a genius! You're awesome!" The kids just light up and they'll keep thinking things to tell me so that I can call them that again. It's amazing how many geniuses you get after a while.

Secondly, she feels that a successful learner is developed from early and repeated exposure to concepts, for the "earlier you introduce them to subject matter and expose them to the different levels of subject matter, the better." Exposing students to a wide variety of experiences, using a variety of media, and repeating exposure to these topics allows the students opportunities to explore and investigate. "Even if they don't get it the first time, just the exposure [is important.] When they get it again, then it clicks!"

Professional development process

Martha really "love[s] technology!" There are samples of her use throughout her classroom. Every center in her room displays a word-processed chart that describes the instructional purpose and objectives for that center, and the daily schedule, word processed and enlarged, prominently proclaims the tasks of the day. On one visit to Martha's room, she had a digital camera dangling from her neck as she snapped pictures of her students for her slideshow presentation that was to run on Back to School Night. In addition, Martha provides a daily trip for her students to the computer center which allows the students to practice drawing with computer tools, perform counting and reading activities, or play games that support the current curricular theme.

When asked what type of technology-enhanced activity she would be interested in putting into practice in her classroom, Martha described her desire to use the power of the Internet to publish student work and communicate with students and parents. She had access to a Web developer the previous year who designed a class page for her Space unit, and she wanted to be able to create and maintain such a publication. In order to create this type of activity, she would need to learn how to create Web pages and post them on the server.

Therefore, the professional development plan Martha undertook was to create a simple Web site that would display her students' artwork from their Ocean study, including learning how to clip graphics from the Web and insert them into the Web page, post the pages to a server, and manage the site. As the resource person, I demonstrated these skills, located resources, and provided support as needed.

While evaluating this professional development experience at its conclusion, Martha commented that the process of the action experiment (brainstorming, planning, acting, and evaluating) was valuable to her because not only did it give her a chance to "form a map of the things that you want to do" and "give you a way to organize those thoughts" with the brainstorming phase, but also develop a plan of skill acquisition that met her needs. For example, the training was conducted away from school in a lab at the local university on

Saturday mornings. For Martha, this allowed her to "really talk about the cool things to do, and we got a chance to look at a lot of different graphics and things. There were no distractions, so that kind of really helped me to focus." Martha commented that she wants to continue working on this project, and felt that a valuable addition to her learning process would be to visit Web sites that other teachers had created so that she could gather ideas that she could apply to her own needs.

Martha was appreciative of the chance to participate in this type of training and added, "I wish more teachers had the opportunity to do [this type of training and work with researchers]. I think that teachers . . . are just afraid of spending time, because they are so booked out and tired."

Relationship between beliefs and technology use in instruction

Martha will be the first to admit that her passion for computers leads her to "make sure that my kids find a love for them as well, because [computers are] now. It's no longer something that's in the future, [computers are] now"; and this passion for computers and media drives her to learn "more about what you can do with it in education, and also on a personal level." She expands further:

> Technology is a big part of our lives so the more we know about it and how to use it the better off we will be. I strongly feel that technology is a tool that we must all learn to use effectively. Integration of technology is essential in today's classrooms.

For Martha, technology allows her students to experience "an incredible fun way of learning that's on their own," and supports independent learning that can be adjusted to the abilities and levels of the learners:

> The higher thinkers will select very interesting and very complex games or they challenge themselves as soon as they reach a certain level. And go to a different level of learning. The kids that are not high like that like to start off with the program that deals with the shapes and colors and then they work they way up. But, I mean, [the computer] still motivates them to keep playing. And, then they want to play something else [at a] higher level. So you can see that each child selects his own program based on his abilities.

Martha also points out that not only will learners select programs that match their abilities, but the computer also gives students an opportunity to "hang out with the higher kids and watch how they play the game or what's going on that particular situation." She allows her students to gather around the computer and watch others playing:

> because the ones that are gathered around the ones that are playing are also learning. They are learning how to play the game. They are learning what words go with what, whether it's Word Concentration or Picture Concentration or picture sequencing, they are learning . . . to me, that's a lot of independent work.

Martha also comments that technology supports the individual's learning process through discovery and exploration. "I want them to discover. And they are doing a lot of that." Martha considers this exploration a form of her students acting as "modern techno-scientists. They are getting on the computer. They are observing. They are experimenting. They are creating. They are gathering

knowledge through observation and doing discovery. That's a lot for a child to do." This process of exploration and discovery means that Martha's students are "on their own learning something; so they feel good about themselves, because they did it." And, this process is a lifelong skill that she would like her students to acquire for, as she acknowledges, "I guess that's why I'm really into computers, too, because . . . I'm experimenting, playing, doing, and there is just so much information there, and I'm learning from doing all that!"

THE MENU-MAKER

Personal beliefs about learning and teaching

I love to read to my kids. . .I'm hoping that by seeing me enjoy reading so much, they'll take that with them and think, "Oh, well, I want to read because these books are so fun." Not like, "Oh, gosh! Reading!" Because I just feel like in 2nd Grade [reading] is the most important thing . . . I just think it's so important to read to kids every single day. —Elaine Burrows, Second Grade Teacher

Elaine's beliefs about teaching and learning center around her view that the educational process is one of partnership between parents and students and teachers, and her role is to provide an educational experience in which "each child [is] given an equal opportunity in school." As a second grade teacher, Elaine views her job as being responsible for creating a learning environment that is geared to accommodate the different abilities and learning styles of her students and as such, functions as a menu-maker who provides an array of educational

choices and instructional opportunities from which the students choose. She expects her students not only to make decisions about choices, but also to do it as independent learners and "independent people. We talk a lot about being respect[ful], and using their manners, and this ignoring someone [who is acting up or bothering others]. I talk about this every single day." As a further clarification of what she considers to be successful expectations, she tells the story of the group of nine administrators who came to observe in her class and who asked the students what they were studying and why. One of the area superintendents was visiting with a table of students, and a student at the table kept seeking attention by calling out "My name is Jesse. My name is Jesse." After a moment, another student in the group sternly addressed the boy, "Jesse, we have really important guests in here. And when you talk loud like that, that's really rude. And, we need to be on our best behavior for these guests."

Another component of her belief that her role as teacher is to provide educational choices for her students is Elaine's belief that mastering the skill of reading will open up choices in the future for her students and promote life-long learning skills. She further explains, "If they cannot read, they cannot do anything independently," and believes that if her students see her "enjoy[ing] reading so much, that they'll take [her example, and hopefully, a love of reading] with them."

Elaine's daily modeling of her love of reading is evident as she prepares the students for a read-aloud session. First, she darkens the room and gathers her students close so that the group feels a sense of belonging and participation in a special event. Then, she turns on the pumpkin lights that surround her October calendar and emit just enough light for the proper "storytelling" atmosphere. Finally, she opens the book, Ramona Forever, and begins to expressively and clearly read the exploits of Ramona and Beezus to her students. Often, she stops to ask questions of the students, either to clarify what she is reading and ensure her audience's understanding, or occasionally to entice her students to predict what will happen next. The students sit attentively at her feet, eyes upturned and watching Elaine's every move, quietly taking in the words that piece together the adventure.

Finally, Elaine believes that parental involvement in the educational process of the child is a critical component for building a successful culture of learning. "If you can get support from the parents and you're both working together, the result is going to be so much better for the child." Elaine promotes interaction with her parents by what she expresses as "calling them on the good stuff," or calling to say, "Your daughter had a great day. I was really proud of [her]."

Elaine supports these beliefs within her teaching practice in multiple ways. First, she uses small instructional groups in order to "put the kids in a position where they're going to get the most out of their learning" and still "make sure they're all on the same page." Often, she accommodates for different levels of academic abilities by providing different resources to different students. For example, her student reading on a third grade level may be reading with third grade materials, and her second grade readers with second grade materials. The students might "all be working on character and main ideas" but with materials that are appropriate to their reading levels. She also uses this approach in math by providing students with "the opportunity to use manipulatives if they need to."

Secondly, Elaine designs her instruction so that all children have an opportunity to learn. Elaine finds that by providing her students with activity choices that allow "a lot of time [for] the kids to be exploring on their own," she ensures that her students have these opportunities. She structures her reading instruction so that those students not involved in reading instruction are engaged in independent center activities where the students are "doing more of the work" and "not [listening to] me talking all the time." These activities vary from "buddy reading" with a partner to the Poem of the Week center in which students work with the poem chart by reading the poem, circling the words with the designated combination (i.e., -ed words). "Once they circle them all, they write them down,

record them." Other activities include working with a large globe that talks to the students about the point on the globe that they are touching with a specialized stylus, spelling the words in a pocket chart and writing them several times, using the magnetic letters on the radiator to build words, and writing journal reflections about the stories they read either independently or with a buddy.

Not only do Elaine's students have a variety of activities and materials to use in choosing learning activities; often, she allows them to choose how they will work on those activities:

> They don't have to sit at their desk for Math. They can go find a quiet place on the floor or they can sit at another empty table . . . .Some like to sit on the carpet, . . . wherever they feel comfortable – as long as they are quiet.

Encouraging an attitude of respect for each other and for the differences of the students in the class is a primary consideration of Elaine's as she designs instruction that promotes the sharing of problem solving or reading strategies. In one math session, the students are sharing problem solutions with their fellow classmates. As they share the answer, they are asked to come to the overhead and demonstrate how they solved the problem. One student gives the wrong answer. Elaine makes no comment, but asks him to demonstrate how he solved the problem. As he works out the solution on the overhead at the front of the room, he realizes that he has the wrong answer, but is praised for the correct solution process by his peers. Elaine stresses the importance of demonstrating that:

> We can even be doing the same problem . . . [Of importance is] showing a lot of different possible solutions on how to get to the answer, but not that the answer is the most important thing. It's more important how they are thinking it through in their head . . . We share all [strategies]. They are all fine strategies.

Professional development process

Elaine received technology training as a member of a student teaching cohort that was provided with laptops to use during preservice field experiences, and she feels that providing her students with opportunities to explore and construct with computers is a valuable use of technology. She currently uses technology for word processing, e-mail, spreadsheets to collect student information, and the school database which records student progress on TAAS/TEKS objectives. With her students, she has used the TV hooked up to one of the computers to demonstrate Web sites on the Internet and Storybook Weaver, a publication and illustration computer applications that students use to add computer-generated illustrations and word processing to their stories.

When asked what type of technology-enhanced activity she would be interested in putting into practice in her classroom, Elaine described her desire to have the children working at the computer more often on activities that allow her students to " go and find something that's interesting to them [on the Internet] . . . and then write a little short" mini-research paper. She was aware that her students would first need "some direction" regarding Internet operating techniques. Elaine felt that the science curriculum topic they were currently studying, animals, would

be a suitable focus for such research activities. And, because she would need to learn new technical skills in order to develop familiarity with a new application and teach it to her students, Elaine was eager to explore construction of these types of activities.

Therefore, the professional development plan Elaine undertook was to first create a web exploration activity that would allow her to acquire skills using the web editor, Netscape Composer, and could be used to introduce her students to the basic operational skills needed for independent exploration of the Internet. The activity was to be used during student center times to practice the skills of clicking on links, scanning a page of text for information, and using the Back button to return to the original window. Next, Elaine wanted to create activities that asked the students to copy an image from the web and paste that image into a word processing document, and then add a sentence telling about the graphic.

While evaluating this professional development at its conclusion, Elaine commented that the process of the action experiment (brainstorming, planning, acting, and evaluating) was valuable to her because it allowed her to develop an activity “more appropriate” and “more supportive of my teaching.” Moreover, “the whole project has really made me think more about how I want to pull in technology.” Elaine can see future uses of this type of activity with her author studies and her ocean curriculum.

Elaine's use of centers, as a means of allowing the students more access to the technology, now has "materials that pertain more to my teaching" and allows students additional opportunities for exploration. Elaine explains that her class had just returned from a field trip to the zoo, and had used background from their web explorations to tie in with their experiences at the zoo:

> They had all done the reptile [web exploration]. The favorite thing of the whole zoo was the reptile area. They talked about iguanas and the snakes, and I thought that was neat because they had explored the reptiles with the [web exploration].

Without the benefit of outside training this year, Elaine enjoyed "going through all the steps [and] seeing what different things made up [the web exploration activity] that we made." She expresses the need for this additional training because "I guess [the school] feels we have a lot of skills and should be able to figure [the integration process] out on our own," but there are other computer-related skills that she would like to explore. For example, the process helped her think "about the students' computer skills more. . . and what I want them to be able to do; I have goals for them now in my mind and I think they could do more." But, she feels she would need "a set amount of time to just sit and work on the project" [in order to] get an idea of how the project would work "from beginning to end."

Relationship between beliefs and technology use in instruction

Elaine explains that she uses technology-enhanced activities as a means of providing a variety of instructional activities in which her students may participate. Technology supports the interaction of student, teacher and parents in several ways. First, Elaine suggests that technology "goes along perfectly with [her students] being independent learners." By giving students access to software games and web explorations in the computer center during her reading instruction, Elaine provides her students with opportunities to explore and discover without a great deal of guidance from her. Elaine feels this independent time with the computer builds computer skills, such as "recognizing the highlighted words [on the Internet] will take them to another link," as well as using the Back button to return to the previous page rather than the Home button. Furthermore, the students work as partners during center time and that permits them to interact, discuss, share their own expertise with computers, and work out the activity themselves.

Elaine emphasizes exploration and free choice through her use of a process that sets parameters for an activity and then allows the student choices about "different directions to go with it. They can choose their animal. They can choose what kind. They can choose the length that they are going to do." She explains further:

> My role is providing them with their assignment, but then letting them have the freedom to explore on their own without me doing a whole group assignment or saying, over their shoulder, "Okay. You need to do this." I'm kind of letting them go a little bit.

And, finally, Elaine pulls her students' parents into the cultural exchange by sending student activities completed with the aid of the computer home with encouragement to the students to go home and say, "You know what? This was really cool. We can go to this site and I can show you how we went to different place.' And they could share the knowledge with their parents."

THE MAESTRO

Personal beliefs about learning and teaching

I believe that we as teachers do everything we can in the best interests of the child . . . that if [I] give 200% and work hard to see that the child makes as much progress as they can while I am their teacher, then they will return the favor to the world. —Ben Ilde, Third Grade Teacher

As the students finish up their activities, Ben Ilde is walking from table to table quietly visiting with his third grade students, orchestrating the learning environment in much the same way as a maestro teaches, encourages, and listens to the members of his orchestral group. Ben stops at one table, and elicits information from the group about their progress. The scene was reminiscent of a master orchestra leader, with his kindly countenance and embodiment of the attitudes necessary for working in the group, yet firm insistence on quality, rehearsing the strings in preparation for them to join in with the orchestra. When Ben and the students have reached an agreement as to the best way to proceed, the

students go back to their work, and Ben walks on to another group. The atmosphere is such that one observes the respectful tone the teacher uses with the students, and likewise, the students use with their teacher.

Ben believes that, as a teacher, he not only plays a role in providing academic enlightenment for his students, but also serves as a model for caring, respectful behaviors and standards of right and wrong conduct. Much as an maestro exudes the attitudes that are to be followed by the individual members of the orchestra in their training and practice, Ben clearly states his expectations for his students. He explains one way that he accomplishes this is to have his students in his current class write letters to the students that will be in his class the next year. He invites these students to share in their letters their experiences in his class, both good and bad, as long as they explain why certain events happened. Then, he reads the letters to his new students at the first of the school year. Most of the letters say, “Oh, he’s really funny” or “He’s a jokester.” However, some of the letters have said, “He makes us laugh, but he can also make you cry” or “He’s mean, and he yells” which Ben notes often “makes the kids scared and stuff.” But, he adds, “I [tell them] . . . It only happens when you are not following [directions] or doing what you already know you should be following or doing.”

Ben stresses these rules of life in his classroom for two reasons. First, he hopes that "the lessons that they've maybe learned in my class or learned about life . . .will keep them safe" from the sad scenarios that happen "right there in their own backyard." Secondly, Ben believes that when his students have figured out their limits with conduct and behavior, they understand the difference between time to work and time to play, which is the learning environment that Ben strives to establish.

Within this type of learning environment, Ben believes that he and his students can have "fun" with the learning process. Ben defines "fun" as "happening when I see the light bulb go on in their faces, and I can see that they are understanding the math or the writing process." On one occasion, the class is creating a Good Work chart for writing response journals to literature. Together they explore and discuss what the first step would be. So eager are the students to contribute to the brainstorming discussion that hands shoot up across the tables in the classroom. Even those students who do not volunteer an answer are attentive and engaged. Just to be sure that all students remain an active part of the group discussion, Ben frequently punctuates the discussion with a yes/no question. "Sí or no?" he asks, and the group responds with a "sí or a "no." Sometimes, the response is not sufficient, and he repeats the question until all are participating, and almost all are smiling.

Another component that Ben believes is important to his ability to provide his students with a quality learning environment is the organization of his curriculum according to the Texas Essential Knowledge and Skills standards (TEKS), the state mandated learning objectives per grade level and content area. The school has taken the organization one step further and defined a timeline for the objectives to be addressed, so Ben and his fellow third grade team members meet once a week, check the timeline to see which TEKS are to be covered during the next week's time period, and set out to plan activities that will accomplish those objectives. Although all third grade classes have the same objectives, different teachers approach the objectives using different activities or types of activities. "You won't walk into all the third grade classes, and see everyone on page 56." Yet, the plans serve as a collection of activities that can be used with these objectives and also provide him with ideas that he could use with his students. Thus, Ben feels that this planning structure actually gives him more flexibility as a teacher to have fun with the kids while they are learning.

Professional development process

Ben personally uses technology for word processing, e-mail, spreadsheets to collect student information, and the school database which records student progress on TAAS/TEKS objectives. He has used word problems created with KidPix to incorporate technology into his math instruction, provided his students

with opportunities to word process their finished narrative stories, and occasionally allows students to play computer games as a reward. Although not currently incorporating technology on a daily basis within his instruction, he felt that he could easily accommodate technologically enhanced activities during his reading center times.

When asked what type of technology-enhanced activity he would be interested in putting into practice in his classroom, Ben described his desire to develop his own technical skills with HyperStudio as he had no experience with the application, and wanted the opportunity to develop activities that would support his unit on map reading and community development.

Therefore, the professional development plan Ben undertook was to participate in a review of the basic operating procedures for HyperStudio and practice those skills, linking together a series of small stacks designed to depict the continents of the world. The next step was for Ben to present HyperStudio to his class, having the students pair off and each pair use their center time to create a continent card. As a final step, Ben would demonstrate to the class how to link the pages together and how to create New Button Actions. Students would again use their center time to complete the stack. As the resource person, I was to be available as needed to help students or teacher during the learning process.

After working with his students, Ben commented that the process of the action experiment (brainstorming, planning, acting, and evaluating) was valuable to him for two reasons. First, the structure of the training was convenient to his schedule; and Ben worked upon the projects with his students as he could fit the process into the already busy instructional day. “And it hasn’t been rushed . . . [the training] has always been very calm and non-stressful.” Plus, Ben prefers the one-on-one instruction with “immediate feedback” provided by the resource person as he was guided through the learning process. He adds that “as opposed to a whole group thing where there’s like 10 or 12 people, I would have been lost even before I sat on my chair in front of the computer.”

Secondly, Ben feels that the experience of working to teach his students during his own learning process is beneficial. He states that:

> Maybe if I knew way too much, I would be way too over my kids’ heads, too . . . I think them seeing me also going through a learning process is good . . . so [as we learn] together they are seeing that we all go through a process of learning.

Several ideas for continuing the use of HyperStudio with his students as they learn the application together have occurred to Ben as he worked through the learning process. For example, he feels these new skills will be useful to his students in the future as they will be able to create stacks that demonstrate how the planets make up the solar system for social studies and stacks for math that demonstrate:

> all the ways they could think of solving a math problem such as '4 x 3'. . . We can do circles and stars. We can draw pictures. We can do arrays. So, they would demonstrate [one solution to a problem] and then click and go to the next way to solve [the same problem].

Relationship between beliefs and technology use in instruction

"It's the whole idea that [technology] is going to be in their lives," begins Ben as he talks about how his beliefs are related to his use of technology in instruction. "[This is] what motivates me to try to incorporate activities, computer or technology activities or games, as much as I can." A moment later, he adds that exposure to using the computer as much as possible may prepare his students for future experiences they might have with technology, and "because [it's used] in relationship to good things or fun or whatever, I think that [it helps] them create a positive image of interacting on the computer."

He further explains that his students show such an excitement about learning skills with the computer, and their enthusiasm motivates and encourages him to incorporate computers into his projects. "They really wanted to learn how. They like the whole 'computer-business' activity." He describes using HyperStudio with two of his students to illustrate how they will strive to use computers in all types of situations.

> [The students] are sitting there in amazement with their jaws on the floor [as I introduced the HyperStudio project to them]. . . They said, "What is this? How does it work?" They were really excited . . . And I told them those [words] were buttons and they can go and click with their mouse and it would take them to several different stages . . . then we attempted to do

> one together, I kind of messed up a couple of times . . . and I lost them, but because they were really excited . . . I guess I needed to model some more.

The next day, Ben worked with these students again. Ben was relieved to see that their enthusiasm had not waned, and Ben felt much more positive about the students' use of HyperStudio. "The [students] understood much, much better. We did a second [stack] together, and it went much, much easier."

THE TEAM BUILDER

Personal beliefs about learning and teaching

What I expect out of them [is] to help each other and work together [and to] share their ideas, not just with their group table, but with the whole group, with the whole class. And that's how we can build. I tell them, "It's our community in this classroom. We have to work together. —Ashley Bob Kostelka, Third Grade Teacher

Ashley Bob Kostelka, her arm encircling the offender's shoulder so that the conversation is one of privacy, discusses quietly with the young man his choices for that particular action. Her quiet, calm manner sets the tone for this active class of third graders, and she walks among them as an equal partner in the educational enterprise:

> I feel that they learn a lot off of each other, not just individually doing their work at their own tables, but learning from each other. I see them going 'Oh, yeah, I didn't think of that that way.' And . . . there are times I want to pull my hair out with them working together, but I see that they really grow to be better students. They just seem to do much better learning-wise.

Ashley Bob sees her role as the teacher as facilitating team building skills by providing her students with daily opportunities to work together. Her reading instruction makes use of Literature Circles, an activity structure that places students in groups, requires each member of the group to be responsible for a different task, and requires the members to then share what they have learned with the other members of the group. The tasks include: discussion director, the individual who directs the sharing sessions for the week, passage picker, the group member who "finds passages they want to share with the group", the word finder, the person responsible for "find(ing) words that are fun, silly, maybe they don't know", and the illustrator, the one who "illustrates something in the story that they liked or just wanted to share with the group." Ashley Bob describes the value of this type of structure as promoting the students' abilities to communicate with "discussion that goes on beyond that about the book," develop "really very clever questions to ask their classmates," and "help each other with reading." As an observer who moves from one group to another, Ashley Bob's participation involves "redirecting them back into the right direction when they are offtrack," often asking questions such as "What about this? Where are you?" but then "letting them carry the discussion." When the group finishes reading their selection, they "present" the book to the whole class through pictures, a short book talk, or in other ways determined by the group.

Team building through group work serves as the backbone for other elements of her instructional day. Ashley Bob designs daily center activity that incorporate small groups and often breaks her students into large groups for the purpose of working of having the groups work on different ideas or content and sharing their information or conclusions with the other groups. For example, on one particular day, the science objective was to explore how vibrations created sound. Ashley Bob had two experiments that the students were to perform, and then explore possible conclusions for the results. She divided the class into two teams and had the student teacher direct the inquiry of why the teaspoon of salt sitting on the membrane-covered cup would bounce up and down when students clapped their hands above the cup. She then led the other team of students in the inquiry of what causes the different pitches of sound when one blows across different sizes of rubber bands stretched across a cup. When each group had discussed and formed conclusions, she brought the whole class back together and provided time for each group to demonstrate and explain to the other group what conclusions they had drawn.

Another aspect of Ashley Bob's approach to team building is her understanding that "every child learns something differently." She believes that part of her role as a teacher is to "try to arrange where I can teach different ways [so that] they can see the different ways of learning one thing." Thinking of

different ways to structure instruction that promotes different types of learning means that Ashley Bob may have to make adjustments and "have to rethink . . . not to do that the next time."

A variety of activities, such as lots of hands-on work with manipulatives, experiments, and projects, is another means Ashley Bob uses to accommodate the various learning styles and abilities of her students. She explains, "I'm doing a lot of the hands-on activities first to kind of get them familiar with what's going on . . . then we look at it in a different form [points to the chalkboard] . . . they need to do the writing process, too . . .solving it actually on paper."

In addition, she feels that she can use the computer to provide her students with a variety of activities. "In center time, I want them to be able to go to the computer and play games" that support general skill development. Writing skills can be supported through the use of Storybook Weaver to publish completed stories.

As director of team building efforts, Ashley Bob describes her contributions as setting and modeling expectations:

> We have these wonderful charts, for good math, good writing, good reading. So that at all times they know what I expect . . . I expect them to work in groups cooperating and sharing. And that's a big problem for a lot of them because they have to share. There are a lot of them that like to be in control . . . they're learning to share doing the projects. [It's] not just "their" project, but the group's project. That's something I expect out of them a lot when they are working together.

With expectations clearly stated in writing and consistently reinforced during group work, Ashley Bob is also aware that she affects the climate of learning with:

> how I present myself to the kids . . . If I don't show excitement [about an activity], my students show the same kind of attitude. The more enthusiasm I show and the bubblier I am . . . the kids reacts in the same manner.

She further describes how responsive her students are to her expectations by giving an example of last week's spelling test.

> Hardly anybody passed it. I didn't understand what happened . . . so we went back and we talked about it . . . and after they all saw their grades, I tore them up [and] said, 'Here's your second chance. It doesn't come very often.' And ever since then, they are really putting more effort into things to show that . . . they're more willing to try.

Professional development process

Currently, Ashley Bob personally uses technology for word processing, maintaining a gradebook, creating lesson plans on Lotus 1-2-3, and accessing the school database that records student progress on TAAS/TEKS objectives. She includes a computer center as part of the centers established for use with reading instruction. A variety of educational software, including Reading Blaster, Math Blaster, and Jump Start, are chosen as they support general reading and math skill instruction. In addition, Ashley Bob uses games that can be located on the Internet, such as flashcards or concentration games.

When asked what type of technology-enhanced activity she would be interested in putting into practice in her classroom, Ashley Bob described her wish to learn to use Storybook Weaver so that she could help her students publish their student writing and illustrate the publications. She has seen how other teachers used the program, but hadn't been able to attend the training session that was held last year; yet, she could see how the program would be valuable for creating a "book" publication for her students.

Therefore, the professional development plan Ashley Bob undertook was to participate in a short demonstration of how to use the software. Then, Ashley Bob and Melissa, the fourth grade teacher, paired up students for a period of 30 minutes each day in order for the partners to write a story. As some students neared the publication process, Ashley Bob and Melissa demonstrated to both classes how to use the software. Students worked on their publications when ready. As the resource person, I provided the training and was ready to assist students and teachers as requested.

At the conclusion of the professional development experience, Ashley Bob commented that the process of the action experiment (brainstorming, planning, acting, and evaluating) was valuable to her, first of all, because it gave her "the opportunity to really experiment with [using technology with students], test [using the technology with students], try it out [with students]" on her own with someone

supporting her learning process. She added that she had participated in the workshops and technology training held during the last two years at the school, but "because we were partnered up, I didn't come out with as much as I should have." The one-on-one format not only supported her learning style and personal acquisition of skills, but "helped me think out the process" from how to use the application to how to use the application with the students in the instructional process. Because she was acquiring skills that would end up in a project she was actually about to use with her students, Ashley Bob found herself asking, "What am I doing? What am I wanting to achieve? What am I wanting them to do?" as well as "How [am I] going to do all this?"

Ashley Bob wants to continue to use Storybook Weaver as an option for students to use to publish their work. Although she feels the application is a viable one for her students to use, she did realize during the process that for students to work independently with Storybook Weaver, or HyperStudio, or ClarisWorks, they would need an "expectations sheet," or rubric which sets out how a quality finished product would look and "a card [typed out] for them with the process" to help them remember the steps for using the application.

Relationship between beliefs and technology use in instruction

For Ashley Bob, she believes that computers are most useful in her classroom as a support for a variety of hands-on activities. As she explains

further, “[The computer enables her students] to go a step further” than with conventional tools. With computers, she feels that her students are able to expand “what they are learning [by] finding [information] on websites” which, in turn, expands their computer skills and knowledge about using computers.

Moreover, the computer lends itself to the concept of team building because no one student is the expert. As all are learning, the team members turn to each other to elicit advice, share strategies, and construct knowledge together. The students tend to call upon each other, even when they are not in groups or partners. “They build off of each other. One will bring up an idea. Then, the other one is like, ‘No, no.’ And they won’t listen to the other one,” but they somehow work it out together. Or, she tells of one situation in which she “explained the situation” for one student, and she saw another student “try it out on his paper, so he was listening to what I was saying . . . I think they don’t realize sometimes that they are learning from each other when they argue and complain, bicker, argue.”

THE SKILL MASTER

Personal beliefs about learning and teaching

I believe in the total education of a child: scholastic, social, and then moral. [The teacher] should be able to draw generalizations and apply them to a situation in [the students’] lives and their experiences [so that the students will] use what they've learned to hopefully solve some problems throughout their life. —Melissa White, Fourth Grade Teacher

After 34 years of teaching, Melissa White has become a master at helping her students find the keys that unlock the skill doors of knowledge. The belief that her role as a teacher is to provide her students with lifelong skills comes out even when asked what type of technology skills she would like to learn, to which Melissa immediately replied, “I would like to have the knowledge, skills and curriculum [appropriate for fourth graders] which would make me feel comfortable in teaching technology in the classroom.”

Melissa approaches her instruction as a means of exposing her fourth grade students to all the categories of skills necessary for success: academic, social, and moral. For Melissa, academic success evolves from having a solid foundation of skills with as few gaps as possible in content knowledge, such as those concepts stated in the state mandated TEKS. “Sometimes, we just need to get back to just some of the basics” to provide the students with background knowledge they need to be successful. Therefore, Melissa concludes:

> different ways to approach different problems. This is only one of the ways, and [the students] can come up with many other ways that problems can be solved . . . but, they have to know that this is [the method] they’ll be tested on.

In addition, Melissa’s instruction utilizes as many resources as possible. Because much of the instruction students in the elementary schools is “ all what they hear, read, and what they see [visible on the walls] somewhere,” she feels that having multiple resources available for her students enriches the instruction,

especially the print resources that are available in textbooks. She is an active participant in the textbook development process and states that "very knowledgeable people have written [these textbooks] which have been based on their research. There's still good information in [text]books" and feels that having this resource available to teachers is especially useful to elementary teachers who are "teaching all subjects in most cases" and have multiple daily preparations She is looking forward to the upcoming textbook adoption that will help teachers integrate the Language Arts (Writing, Spelling & Grammar) into the Reading program. "It can be done easily," and helps teachers find the time to introduce other concepts that students will require to successfully pass the TAAS test in the future. "In a couple of years, those who are third graders now will be taking the Science/Social Studies TAAS test," and with the correlation of Science/Social Studies vocabulary topics with the Reading adoption, teachers will have a valuable resource for introducing and reinforcing concepts from these subject areas while addressing their Reading skills.

Skills necessary for social success, stemming from Melissa's belief system, include those that allow the student to "develop a sense of personal wealth, pride, self-respect, and respect for others. All of this is very important in our society—getting them to get along with one another." Melissa feels that the teacher supports this development by "arousing curiosity of the children and

nurturing" that curiosity by presenting the children with "many opportunities for them to work and learn together." She further states,

> I like to see the kids do a lot of the teaching and the teacher being a facilitator. I mean, that's what we're working towards. Let them do more of the talking and discussion, rather than the teacher. That can be accomplished through practice, modeling.

Her writing lessons are punctuated with opportunities for the students to practice working and learning together. On one particular day, the groups are actively involved in creating a second paragraph to stories under construction. On the board are the four components that the class has decided to include in today's paragraph: an anecdote (story), a cause-effect situation, feeling of the characters, and one quotation. Melissa walks among the groups, listening to the conversations and asking brief questions. Finally, one group raises their hands, ready to read their paragraph to the group. All students stop and listen attentively to the story. Together, they go through the four components listed on the board. "Is there a story? Is there feeling? Is there dialogue? Is there cause and effect?" When the review comes to "cause-effect," the reader goes, "Oops!" and Melissa just smiles, "Well, see if you can add it in!" Then, Melissa says, "Go!" to the group, which is the class signal that they should resume work on their own group story. The process continues until another group raises their hands, ready to read to the group.

The discussions among the groups vary from how the sentence should be written to the format of the writing. One student tells another group member, "Hey, you're supposed to have your best handwriting or we won't be able to eat in the classroom on Tuesday." The student points up to the Good Work chart for Story Journal Writing where one line on the chart reads, "Do your neatest work." The student continues in her comment, "We've got to be sure and do that!"

As the groups begin to finish their paragraphs, Melissa begins to focus the groups more to the format of the writing, such as indenting paragraphs, line spacing, and checking spelling. Another group has just about finished, when one of the group members announces a dislike for the story. Melissa emphasizes the give and take relationship of group work by reminding the student that the storyline for the group story was decided upon long ago, and now is the time to finish what the group has written. Melissa reminds him that they will be writing more stories tomorrow, so he can "think about what [he] would like to change for next time, so [he] will like it better when [the group is] finished."

The jobs assigned in the writing group work also provide the students with opportunities "to learn cooperation [and] how to get along with one another . . . Taking turns, one person speaking." Through their assigned role, the students are responsible for completing a part of the group writing. "They have a writer, a prompter, a reader and then you've got a leader . . . It's a way of keeping them

focused on what's going on" and permits the students to collaborate on completion of the project.

Setting and meeting expectations for behavior and effort are the basis of what Melissa feels are the skills necessary for moral development. Expectations are not only visible throughout her room in the Good Behavior and Good Work charts that state expectations for quality work in Reading, Math, and Writing, but also in the instructional process Melissa uses with her students. She explains she begins her lessons by saying:

> This is what we are learning. Now, let's discuss why." Then, as we go along, [I ask] "Why are we learning this? How is it going to help us now? Maybe later on? Tomorrow? Ten years from now?" Then, we start talking about how they can judge good work. "What is a person looking for? If I walk by, what can I see that you've done that tells me it is good work?" Then, we're trying to let them figure out, "If it's not good, what can I do to make it better?" [The student might need to] just recopy it . . . [so] another person can read it.

Additionally, Melissa strives not only to make the students clearly aware of expectations, but also to make the connections between those expectations for quality schoolwork and the lifelong skills they need to be successful in their lives outside of school:

> Maybe they can take [what they've learned about getting along with others and meeting expectations] and use it in their after school activities, with other regular activities. A lot of them are in sports, dancing, Girl Scouts, Boy Scouts, [and other] kinds of groups.

Emphasis on real world relevance often takes the form of visitors to Melissa's classroom. During the class study of Indians of Texas, she invited one of the ladies from the Indian Nation's Tribal Council meeting to visit with her class and demonstrate basketweaving and other native Indian crafts. A weekly visit from the gentleman from Junior Achievement enhances her thematic unit of communities and city planning. And, when the class was writing narratives, Melissa invited the curriculum specialist to come to the class and work with her students.

Professional development process

Melissa personally uses technology as a word processing tool, a record-keeper of her students' progress on the school database that tracks progress on TAAS/TEKS objectives, and a vehicle for communicating with colleagues via e-mail. Although Melissa has passed the district technology competency and attends technology-oriented workshops, she expresses frequently that she is ill at ease with the technology. However, she does not believe that her competence is necessary for her students to use the computers, especially since they are fourth graders and have had experiences in technology-rich classrooms in second and third grades.

When asked what type of technology-enhanced activity she would be interested in putting into practice in her classroom, Melissa was eager to use

centers to teach computer skills that would be needed later in the spring for a required research project. However, before a plan of action was devised to implement this particular interest, she and the third grade teacher in the adjoining classroom, Ashley Bob, realized that both of their classes were working on writing narrative stories. In an effort to set up a learning environment that would promote sharing of skills and writing expertise between the third graders and fourth graders, Melissa and Ashley Bob agreed to work together on the same activity, supporting each other as they introduced the software to their classes and supporting their students' use in the activity.

Therefore, the professional development plan Melissa undertook was to first participate in a short demonstration of how to use the software. Then, she and Ashley Bob, the third grade teacher, paired up students for a period of 30 minutes each day in order for the partners to write a story. As some students neared the publication process, Melissa and Ashley Bob demonstrated to both classes how to use the software. Students worked on their publications after finishing the rough drafts. As the resource person, I was available as requested to support teachers and students.

While evaluating her experience, Melissa commented that the process of the action experiment (brainstorming, planning, acting, and evaluating) was valuable to her because it gave her an opportunity to practice using Storybook

Weaver. “The more you use it, the more you become comfortable with it, and therefore, you’ll just automatically put it into your curriculum and not even think twice about it.” And, Melissa feels that she will be able to use Storybook Weaver again “in their Indian unit, or any kind of historical event. They can write stories and create the different pictures,” and was pleased with the manner in which the children worked with the application and with each other. As a culminating activity, Melissa would like to invited Ashley Bob’s class into her room and “have a little social, a little get-together, a little storyweaving time, and let them share [their stories] with everybody . . . on the computer.”

Relationship between beliefs and technology use in instruction

Melissa’s belief that her role as teacher is to provide her students with a learning environment that is reflective of real world experiences leads her to feel that she must teach her students how to use technology because “it’s a part of our lifestyle . . . Technology is faster, gets us where we need to be at a faster pace.” Her students show a real excitement about working with computers, and “when you see [students] getting excited about it, that just makes you want to do more in technology.”

Furthermore, Melissa believes that technology could support the acquisition of social, academic, and moral skills of students by providing students with opportunities to work together, gain expertise in computer skills, and create

quality work; however, at this time, she feels that the district does not have a curriculum that supports computer skill acquisition for students or teachers, at least not a "curriculum written where we [the laymen] can understand it." In Melissa's view, the training provided for teachers has a strong emphasis on the application and how to "do" the application, rather than how to use technology in instruction or the skills students need to work with the application. "I don't know how to interpret [using the application in instruction,]" and Melissa adds, "If they'd just give us how to get from Plan A to Plan B, we could implement [technology]." Without the help and support of "the very cordial" group of co-workers at her school, she feels that "I would be lost."

THE VOYAGEUR

Personal beliefs about learning and teaching

I saw two different teaching philosophies [as a student teacher]; one I couldn't stand and one I really liked . . . The one I couldn't stand was the one where the teacher stands up and tells the kids how they want it done, tells them exactly how they want them to talk to them, [and] basically structure[s] their life around the way they want to hear it. And that bugs me, because not every kid is the same and you shouldn't cram them into a shell. At least that was my opinion. The other [way] was, yes, you still have to have structure, and you still have to set expectations, and you have to have goals for the kids to reach, but [the teacher] doesn't have to be the only source of those goals, and [the teacher] doesn't have to be the only source of those expectations. —Stephan Lynch, Fifth Grade Teacher

Stephan Lynch, fifth grade teacher, could serve as a walking advertisement for a teaching style that says "Got an idea? Let's do it!" He

explains his "voyageuristic" attitude as being not unlike the voyageurs of 18th century French Canada who savored the excitement and adventure of transporting people and goods through uncharted wilderness. Stephan explains that his voyageuristic spirit springs from his deep belief that teaching and learning is a process of interaction between student and teacher.

He illustrates this point with a story about how this attitude shows up in his teaching:

> Ideas just hit me in the middle of us doing something. For example, last year, I was up talking about [Indian culture and their folklore] and the idea hit me to have them write their own. I didn't plan anything around it. I didn't plan on even doing it . . . so I put them with partners and their assignment was to sit down with their partner and figure out something in nature that happens that they could explain in such a way like an Indian would explain it. And, we had read Legend of the Indian Paintbrush and Legend of the Bluebonnet and some of those books. Then, after they had done that, they brainstormed ways that they could write their stories.

After students had written, edited and rewritten their stories, Stephan continued the activity by allowing the students to use Storybook Weaver to illustrate and publish the stories in a class book that "we then put our book in the library, put a barcode on it and everything, for people to check out." Thus, Stephan describes his process of designing instruction as "real sketchy" in that he thinks of the instructional objective, then "the activity we're going to do. These are the materials that I need. And, that's about all I put down. I don't even work out what I'm going to say by any means." But he further explains that "I know in my brain

what I want the kids to have in their notes. Whatever that happens to be is what I'm going to put on the board. I already have a pretty good picture in my mind."

He also adds that he doesn't write out detailed plans because:

> I don't think of stuff until we're reading through it. We'll be reading through something, and I'll think of something to add or interject into the conversation. And, some of it also depends on where they go with their questions. I think that goes back to that "don't want to cram them into a shell" theory, because they sometimes come up with ideas or questions about things that really need to be expanded on. But if I'm trying to cram them into my shell, they would never even get there.

A flexible teaching style also allows Stephan to utilize activities in his instruction that support the interests of the students through real world relevance. He gives this example:

> This year somehow or other we got onto the subject of gangs. These kids know more about gangs than anybody I've ever known, which is sad, but one of them brought up [gangs] when we were talking about Indian tribes. And I said, "So explain this to me, because I don't know anything about gangs." So they started telling me stuff. And the more they talked, the more the correlation or the parallel was there between Indian tribes and gangs. But what I pointed out to them is that gangs are just basically a side [society] parallel to society as a whole anyway, and that you could probably take anything and parallel it ... any group of people and parallel it to a gang in some sense. So . . . that went on for 45 minutes. We were talking about gangs . . .And every single kid in this classroom was glued to the conversation. So if that's what it took to get them glued to the conversation, so be it. But there's no way I would even bother to write it in my lesson plan. The very first lesson in Social Studies . . . is I ask them, "Why do we study Social Studies?" They give me [various] answers. I'll say, "To me, the reason we study Social Studies is because history has a tendency to repeat itself. And if we don't learn from the mistakes of the past, then we'll never prevent them in the future." I said, "You may not see how the Indian thing repeats itself," and two days later is when we got into the gang thing. After I had said that, two days later, I looked over at one of the kids and I said, "What did I tell you a couple of days ago?" And they

> said, "Well, history repeats itself." And I said, "And now we're talking about gangs.

Stephan also believes that it is important to bring real world relevance into as many activities as possible:

> We have to draw those correlations. On Fridays, we do menu math. Heck, it's multiplication, it's addition, it's subtraction, it's division, but it doesn't look like that. It's math. It's menus. You're playing like you're at a restaurant. It's all those fun things. It's a real-world application, but you're still doing math.

Stephan's "voyageuristic" teaching style of "just doing" ideas as they emerge from the actual instructional event is just one example of his teaching belief that the role of the teacher is to "lay parameters for what the assignment is, but leave enough latitude around the assignment for [the students] to take it in whichever direction they see fit." He firmly believes that his "job is simply to facilitate that education . . .to give them the knowledge that they need to go to the next level," and this style of teaching works for him because he sets clear expectations for student performance and behavior at the beginning of the year in two areas. First, Stephan explains, "By the time they get to 5th Grade, they should be responsible enough for their own education." Accepting the responsibilities of doing the work required and putting out the effort to succeed academically stems from Stephan's own experience getting though college, and he realizes how important it is for students to "do it your own way, but your way better include

you doing your part for your education." He feels that the teacher can encourage students to take this responsibility by giving them:

> the idea that you trust them to do things. If you give them an assignment, and you trust them that they will get to the end of that assignment in some form or fashion. I think that sometimes puts a little belonging to them that they don't get elsewhere.

Secondly, Stephan feels that expectations for quality student work must be established before instruction begins. He describes his use of the Good Work charts that the class has created to show the necessary components for good work in math, reading, and writing. The charts are stationed right next to the boxes where the student turn in their work so "that before [the students] turn in their work, they can turn, hold their paper up to the Good Work chart and see, 'Did I do it the right way? Is it ready for me to turn in?" In addition, Stephan discusses these concepts of quality work with his students before, during, and at the conclusion of the instruction.

And finally, Stephan adds to his description of the role of the teacher as someone who not only allows for structured exploration of student interests and goals, but is there because he "wants to help kids be kids, but also be learners." Often, this means showing respect for the students through attending football or basketball games, or talking with students who just need an adult's viewpoint. Stephan often walks across the hall to show other teachers the great work that his students can do. With genuine amazement, he will say, "Can you believe a 5th

grade student can do such beautiful work?" Or, he'll pull those passing by into his room to see work in progress of his students. His obvious pride at the abilities and talents of his students fosters respect between teacher and students. But, he feels "it's easier for me to get them to buy into what I'm doing if they feel like I actually care."

Professional development process

Stephan thinks of the computer as a tool in the classroom and expresses "that it's [for] work, but when I go home, I like to play on the one at home." He often uses the resources of the Internet to supplement a classroom discussion or extend a lesson. For example, his students wrote and word-processed their goals for fifth grade and what makes them special for the Back to School bulletin board. He added their pictures, taken with a digital camera, to the document, which he then printed in color and laminated. In addition, his students have been using Storybook Weaver to publish "books" they have written about castles so the books can be placed in the school library, and Stephan always gives his students the option of using computer tools to create a finished project.

When asked what type of technology-enhanced activity he would be interested in putting into practice in his classroom, Stephan was keen to learn PowerPoint, a slideshow presentation application. He was familiar with the ClarisWorks presentation capability, but felt it was too cumbersome for his

students to use. What he was really looking for was an application that he could use as a discussion tool in Social Studies and Science, one that could be used to introduce vocabulary concepts, review information with his students before a quiz, and visually present concepts that students would be using in the future. In addition, he felt that his students would be able to use PowerPoint as another option for presentation of their project-based learning activities.

Therefore, the professional development plan Stephan undertook was to participate in a demonstration of the basic operational procedures of PowerPoint. He would create a couple of presentations to use in his instruction while he was mastering the skills, but would then teach his students how to use the application so they could make presentations at the end of project work.

While evaluating his professional development experience, Stephan commented that the process of the action experiment (brainstorming, planning, acting, and evaluating) was valuable to him because it suited his learning style, in that Stephen learns technology best by "just having the basics and then just leave me alone and let me do it." He recognizes that others may need more support and reflects that they really need someone:

> to sit there and hold hands the whole time . . . and be there as a crutch to do stuff . . .but that slows me down. Show me how to use it, be available somewhere if I have a question that I can ask so I can move on. It's hard to open up a program for the first time and not have any clue where to start. Once I had a clue of where to start, I could go crazy. [My wife] had three

> hours of training on PowerPoint Friday, and I know more about it than she does [from his 30 minute training session].

Stephan has already created two presentations using his new skills: one for classroom instruction and one to serve as a backdrop to a song his class performed in a school program. He feels that the use of PowerPoint is a viable choice for his students and looks forward to "learning it really well" so he feels comfortable using it professionally. As to how he will continue using it in the classroom, Stephan grins and explains, "I'm just going to have to evaluate it after doing it, reflect upon it" to see how he will fine tune its use after he has presented with it a few times.

Relationship between beliefs and technology use in instruction

Stephan sees his use of technology as a natural outgrowth of his teaching role to support the interests and needs of his students. He explains the inclusion of technology in lessons as first starting "with the idea and then look[ing] to see how Storybook Weaver would enhance the lesson." For him, "technology doesn't drive the lesson, but must fit into the activity." The planning process Stephan uses goes through these three steps: "Here's what we're learning about; what do I want the students to come away with, and can I use technology some way to get it done?" Stephan cautions that "we [teachers] need to really be careful about when we're using technology in the classroom that there is actually a purpose behind it.

It's not just putting [students] on the computer because that's what we're supposed to do."

In carrying out his planning process, Stephan finds "that I try using it if it's at all possible" and calls this his "spare no technology" attitude. "If we've got the equipment available, we'll use it." He finds technology especially appropriate for his students to use when completing projects that they present to the class for two reasons. First, "kids tend to do the project if it uses a computer . . . computers motivate many of the students to do the activity better than [if I asked them] to just do a project." And, secondly, "they need the exposure to different variety of technology available to them. We'll take pictures and scan them in so that they can use them in their projects."

Stephan further elaborates that he just wants his students to recognize that they have options for completing assignments or creating a project, and some of those options include technology use. "The more students use technology and understand how to use it, the better off they are. Technology is not going to go away, and [the students] are interesting in [using] it." But he also feels that there is:

> room in this world for kids to do things the way we used to in shadow boxes and posters and all those kind of things, because it's just a different way. I guess the computer, to me, is just another way for the kids to get their projects or whatever presented to the class. Or in the sense of word processing, some of these kids whose handwriting is atrocious, it's a way that they can get their point across without holding them way back from the handwriting end of the deal.

CHAPTER 5

Themes

The lessons to be learned from findings resulting from this inquiry are generally decisions that remain the responsibility of the reader, but the findings may suggest possible consideration in various contexts of teacher education and technology training. Documentation of the common themes that emerge from the thought processes that teachers experience as they endeavor to incorporate technology into their teaching practices based upon their beliefs about teaching and students can provide useful insights for those who develop technology training for teachers. Thus, these themes are not meant to be generalizable to other situations, but to provide direction "for the investigation of others" (Erlandson et al., 1993, p. 45).

THEME #1: TEACHERS' PREFERRED EDUCATIONAL USES OF COMPUTER-BASED TECHNOLOGIES MAY BE RELATED TO THEIR NOTIONS OF THE RELATIVE IMPORTANCE OF STUDENTS' INTERESTS AND PREFERENCES VS. TEACHERS' PERCEPTIONS OF STUDENT LEARNING NEEDS WHEN PLANNING FOR INSTRUCTION.

Teacher beliefs about relative importance of students' interests and preferences vs. teacher perceptions of student learning

As the participants shared their beliefs about learning and teaching, the belief that the instructional event should be designed to accommodate elements of

students' interests emerged in two forms: the expressed belief that the teacher's role is providing instruction that nurtures and supports the interests of the student, and the expressed belief that the teacher's role is to provide skills training they perceive as being necessary for the students to be successful outside the classroom in a real-world application.

Four of the participants: Stephan, Debbie, Martha, and Elaine, expressed the inclusion of student interest in instructional activities as part of their beliefs about the role of the teacher. Stephan referred to the inclusion of student interest as a means of structuring instruction so that the teacher is not the "only source of those goals, and [the teacher] doesn't have to be the only source of those expectations." To keep from "cram[ming] [his students] into a shell," he purposely keeps his lesson plans "sketchy" and flexible, so that discussions and activities can be adjusted "to go with [students'] questions . . . because they sometimes come up with ideas or questions about things that they really need to be expanded on."

Similarly, Debbie believes that allowing students to explore whatever is interesting to them is the heart of the Pre-K instructional program so she is prepared to make her lesson plans on a daily basis, if needed, to support their learning interests. Debbie explains it this way,

> You can talk about friends and what good friends do until you're blue in the face, but if all they want to talk about is caterpillars and the aquarium, they are not going to learn anything about friends, where you have the

> opportunity for them to learn mountain of information about caterpillars because that's what they're interested in.

Martha describes her use of providing experiences that follow student interest as a matter of setting up situations that "allow [the students] to be themselves a lot" and make choices about what they want to explore. She feels that real learning occurs when the students have an opportunity to explore and discover and share those ideas and discoveries with others. She further adds that:

> I'm a let's do, let's play, let's learn, let's discover, let's experiment [teacher]. That's the kind of teacher I am. "Let's go on the ground. Let's go look for this. Let's get it in a jar. Let's look at it. Then let's let it go." That is time consuming, but it's real learning. It's real life learning for the kids.

Elaine also views inclusion of student interest in instructional design as a means of providing students with choices. Elaine explains, "I really like to give them a lot of choices;" and although she establishes the parameters of the instruction for her second graders, she also provides her students with a variety of activities from which to choose and allows them the flexibility to choose their working environment.

The other three participants expressed the idea that educational experiences should support the learning needs of the students rather than their interests. They described their roles as helping students satisfy those needs by making instruction relevant to the student's world outside the classroom. Thus, instructional design that incorporates real-world tools and procedures were perceived as valuable support for these learning needs. For example, Ashley Bob

provides a variety of hands-on activities for her students to support the many different learning styles of the students in her classroom. She further adds, “I try to arrange where I can teach different ways for them to see the different ways of learning one thing” in hopes of creating a learning environment where different strategies and differences are valued. She feels that learning to cooperate in groups to solve problems and create projects will prepare them for living in the world outside the classroom.

Melissa and Ben expand upon this idea in their belief statements. Melissa re-iterates on several occasions the need to prepare students for the skills they will need in real-world applications. She gives the example of her students working with the third grade students in Ashley Bob’s class and explains:

> [The students] were working cooperatively in groups in different age levels. And in the real world, you never work with the same age group. There's always a variety of age groups that you work with in most cases. So that takes you out into the real world there. If we don't teach them how to get along with one another, they do have a tendency to have social problems.

Ben agrees that preparing his students to live in the world outside the classroom is also a cornerstone of his belief statement, but he emphasizes the need for his students to learn how to behave in school situations and transfer that knowledge to the real world. He explains to his students that they:

> get breaks at school. You get out into the real world and you steal a pack of gum or whatever, you're going to be going straight to jail. There's no in between. There's no sit out for recess, or fill out this form, or [being

> asked], 'What could you have done differently?' No, out in the real world, you are taken in. Maybe you'll get a chance to explain or whatever, but it's going to be a harder lesson to learn then.

Preferred educational uses of computer-based technologies

The difference in manner of stating beliefs about how teachers feel they should design instruction that best suits their students also reflects in their overall use of computers in the classroom. The four participants who expressed a belief that the role of the teacher was to provide an educational environment that encouraged the exploration of student interests also expressed that they incorporated the computer more into their personal activities, use the computer more with their students, allowed their students time to explore freely with computers, and use more technologically-enhanced activities with their students. Martha explains, “While I am working at a table, the computer is either being used as a center tool by children or is printing information for me, so it appears like the computer is on constantly.” Debbie describes her use as stemming from the constant need in her classroom to answer student questions.

> We go to Ask.com a lot. The students will even say, “Let’s ask the man about it…you know the man on the computer” because we often use the search page for Ask.com which has a picture of Jeeves on the page.

Stephan describes his use as a “spare no technology” attitude. After looking at an instructional objective and planning an activity, he looks for ways to use technology during instruction. In addition, he uses the computer with “spur of the moment” activities, such as Internet searches for topic investigation and

information collection, allowing students to construct crossword puzzles with an online crossword puzzle maker, and word processing of student writing, so that the computer is a tool that is constantly being used. And, Elaine feels she is constantly looking for more ways to provide her students with opportunities to explore and discover the computer, as well as giving each student a set time during centers to use educational software and activities she has constructed. For her, the computer serves as a tool for exploration.

On the other hand, the three participants who expressed their beliefs about making connections between students and learning as providing students with experiences that prepare them to succeed "in the real world" present their students with fewer and more structured opportunities to use the computer. While Ashley Bob schedules a daily center time in which students use educational software and helps her students use HyperStudio and ClarisWorks to publish stories, she confesses that she is "experimenting" with the "thought process of it all" and hopes to do more.

Although Melissa and Ben use the computer daily on a personal basis to check e-mail and work with the school's database, they usually use the computer with students only as a means of supporting special projects. For example, Melissa uses the computer to word process many of the charts and displays she has in the room. When her students made "book review floats," a cereal box

covered and decorated like a float to represent ideas from the books the students were reading, she allowed the student teacher to word process the titles for the floats. Students were able to pick out the fonts they wanted used on their floats. Ben has used the computer with his students in publication of student writing and creation of special projects, but expressed excitement at learning how to use HyperStudio with his students and working with a few students at a time. Technology is valued as a real-world tool that supports real-world applications, and as such, fits into instructional designs that require this tool.

THEME #2: BELIEFS EXPRESSED BY TEACHERS ABOUT LEARNING AND TEACHING ARE RELATED TO TEACHERS' USE OF TECHNOLOGY IN FOUR WAYS:

- **Why technological tools are perceived as valuable to instructional activities**
- **How technologies are incorporated into activity structures**
- **How technologies are used to support curriculum**
- **Why technologies do not support all instructional activities**

The participants in this study have revealed the use of various instructional methods, practices, and activity structures as a means of describing how their beliefs work in their classrooms. Just as the beliefs are related to teacher choice of instructional methods, practices, and activity structures, the participants explained how their beliefs are related to the use of technology within instruction. These relationships that emerged were classified into four categories: why technological tools are perceived as valuable to instructional activities; how the teachers

incorporate technology into their activity structures; how the teachers use technology to support the curriculum, and why technology does not support all instructional activities.

Why technological tools are perceived as valuable to instructional activities

Study participants are in complete agreement about the value of incorporating technology into the instructional process, basically because the use of computers is not an isolated skill, but rather a true example of students using tools that are used in the workplace and the real world outside the school walls. Technology makes the link for students that the tools they are learning to use in school are the same tools they see being used in the grocery store, the doctor's office, the local library, and offices and stores everywhere. Melissa laughingly calls technology "the in thing right nowadays," but she states that she wants to be sure her students become aware of "how they can use it later on in junior high and high school, to benefit them in whatever they might be doing in the future." Other teachers express the idea that the use of computers is becoming so interwoven within the fabric of our society, that student acquisition of technology skills is of real importance. Stephan also wants to be sure that his students have computer skills for later use and will incorporate a variety of technologies into instruction, such as taking pictures and scanning them in for use in projects. He explains, "If

we have the equipment available, we'll use it." Ashley Bob reflects upon it in this way:

> Computers are going to be there forever. And I think the knowledge of it is just going to keep growing. I myself need to learn more so I can help them, because computers are going to be there forever and who knows how far they're going to expand it. [The students] are going to have to know it, kind of like they know their reading and writing and math. They're going to have to know computers as well, especially for a job.

Ben believes that technology "relates on many, many different levels and can be introduced into any content area," and Debbie uses the computer to tie the students' interests to the world around them. For example, Debbie and her class looked "at fall leaves in Vermont and other places on different websites," then they took a field trip out into the fields and playground surrounding their school and collected leaves from the trees to compare with the pictures they found on the Internet. Elaine also values technology for its ability to tie classroom instruction to the world outside the school walls, and was delighted that during her second grade class trip to the zoo, the students were highly interested in the reptile area. She couldn't be sure it was because the class had just completed the Web Exploration on reptiles that allowed the students to search and explore about reptiles on their own, but she felt it did have an impact. Perhaps, Martha sums it up best for the group when she says:

> Technology is a big part of our lives so the more we know about it and how to use it the better off we will be. I strongly feel that technology is a

> tool that we must all learn to use effectively. Integration of technology is essential in today's classrooms.

How technologies are incorporated into activity structures

These teachers use technologically enhanced activities in their instruction because they believe that such use will provide a successful learning experience that fits in with the activity structures they believe best support their students' learning. Although these participants describe multiple means of designing instruction and putting instructional techniques into practice, five activity structures emerged across informants as being in use in their classrooms. These five structures include:

- Centers (Independent activities or tasks that are assigned to individuals or partners and usually completed while the teacher is working with other children in a small group or individual setting)
- Discussion/Group Practice/Independent Practice (A three-step process of 1) discussion between teacher and students regarding content or skill, 2) group practice in which teacher and students practice the assignment or skill together, and 3) independent practice in which the student practices the assignment or skill independently or in small groups)

- Small-Group Work (Teacher breaks students into groups that either work together to complete a task or support each other in the completion of a task)
- Teacher-led Whole Group Discussion (Teacher presents concepts or skills to group while encouraging questions and discussion)
- Project-based Learning Activities (Individuals or groups construct a project that represents and illustrates knowledge gained or conclusions formed)

Centers

All participants, except for Melissa and Stephan, use centers as a structure for some part of their class day. During center time, students are working independently to explore/discover or complete an activity assigned by the teacher. Although Stephan admits the use of centers, defined as the use of a set of teacher-constructed independent activities available on daily basis for the students, is "way too much structure and organization for me to go through to make it work right," he does provide a time during the day when students are working independently on different activities, such as Daily Oral Language or Journal Writing. And, Melissa expresses an interest in using centers in her room but she "just hasn't found the time to get them organized."

Discussion/Group Practice/Independent Practice

A second activity structure, the three-step process of Discussion/Group Practice/Independent Practice is used by all the teachers and takes on different forms at different grade levels. At Pre-K, K and 2nd grade, the teachers refer to the use of "story response," a process Debbie and Martha describe as reading a story together, discussing different parts of the story, such as what was each person's favorite part, and drawing a picture that illustrates their favorite part. Then, the student is asked to write the letters of the picture or words to a sentence. Elaine explains that, in second grade, this is referred to more as a "writing activity," in which the teachers and students construct a story together and then individually practice writing the story. The 3rd, 4th, and 5th grade teachers use "writing process" to describe their version of the activity structure. At this level, the activity includes a teacher-student writing/discussion session in which the teacher demonstrates skills needed and together they construct an example. Then, the students work independently to create their own story or stories. The upper grades add to the process by including a time after the student writes the story for a cycle of peer editing, re-writing, teacher editing, re-writing, and some form of formal publication of the story, such as re-writing the story neatly or illustrating the story.

Small-Group Work

The teachers also employ many incarnations of the third activity structure, small-group work. Generally speaking, the small-group work structure breaks the class into groups of three or four students who support each other in the discovery/exploration process, completing a task, and drawing conclusions or developing strategies that can then be shared with the whole class. The small-group work structure is utilized by the teachers in many ways depending upon the purpose of the group. Stephan and Ashley Bob use Literature Circles, a structure that groups students together, assigns each student a role to play in the group, and the assignment of reading the selected books and working together to present the book to the class. Debbie, Martha, and Elaine pull small groups for individualized instruction while other students work on center tasks. Melissa and Ben use small groups to work together to complete writing or math assignments.

Teacher-led Whole Group Discussion

A fourth activity structure, teacher-led whole group discussion, appears to be a useful structure to all of the teachers. For Martha, "morning activities," where the students "read around the room" and practice counting, are conducted using this structure. In addition, she often uses the structure to begin brainstorming topic investigations for their KWL chart (students construct a chart showing what they Know, what they Want to know, and reflect about what they

Learned at the end of the activity.) Debbie also uses the structure as a means of conducting her "daily class time" with her Pre-K students, in which the whole class talks about the topic of the day and provides opportunities to talk in a group and practice reading readiness skills. Stephan uses teacher-led discussions as the format for his Social Studies and Science instruction in which the group reads and discusses the information for the unit together, and Stephan helps his students take "notes" and organize the information they will need to know for quizzes. Ashley Bob, Elaine, Ben, and Melissa use the structure as a means of sharing strategies and problem solving ideas, especially in math using a variety of hands-on activities. Plus, Ben adds, "Sometimes when I try to squeeze [instruction] in very quickly, I do a mini-lesson where the kids –poor things—just sit there and I'm throwing out all this information."

Short-term Project-Based Learning Activities

Short term project-based learning activities, a fifth activity structure in evidence among the repertoire of activity structures for these participants, is used by the teachers often as a culminating activity for a thematic unit of study. Ben and Ashley Bob had their third graders construct communities out of buildings constructed of milk cartons; Debbie's Pre-K students created a tree with real leaves, bark, branches, and roots collected by the students; Martha's students created an animal book in which each other the students created a page about an

animal to go in the book; Melissa's students created their "book review floats" for display in the library; Elaine's students created Venn diagrams in math; and Stephan's fifth graders wrote castle stories that they collected, bound into a book, and made available to student checkout through the school library.

The participants in this study describe these five activity structures as the methods they use to design instruction, supporting what they believe are the methods through which students learn best. The use of these activity structures as vehicles for delivery of instruction, in turn, influences the manner in which technology can be used to enhance instruction. Thus, the participants describe their use of technology as an outgrowth of support for these five activity structures. For example, all the teachers frequently use desktop publishing of student writing. Desktop publishing can be used to publish writings that result as the finished product of a project-based learning experience, the three-step demonstration/group practice/ independent practice structure, or the teacher-led discussion group activity structure; in addition, desktop-published work can be accomplished using the centers/independent work or groupwork structures. The participants were able to describe many ways that they have incorporated desktop publishing into their instruction using not only the word processing tools available with ClarisWorks, but applications such as Storybook Weaver, KidPix, and even a little Web publishing.

Other technologies that the teachers believe are successful in their classrooms include use of educational software, Internet games, and teacher-created multimedia activities that can be used in independent settings such as centers or in small groups. The use of draw applications to illustrate stories or create pictures, including those created with KidPix, HyperStudio, and ClarisWorks Draw; and the use of multimedia, such as KidPix, HyperStudio, or PowerPoint, to present projects resulting from project-based learning activities, are also viewed as valuable and supportive examples of technology use in instruction.

Specific examples of technology use within these activity structures are evident. For example, Martha, Debbie, Elaine, and Ashley Bob are using internet games, educational software, teacher-created HyperStudio stacks, and draw applications such as KidPix and ClarisWorks Draw as independent activities within their center and small-group work structures. The components of the discussion/group practice/independent practice activity structure are supported through the use of a variety of applications. The discussion component of this activity structure, as well as the teacher-led whole group discussion activity structure, find Stephan using PowerPoint and HyperStudio to present content to his students, and Debbie, Ashley Bob, Melissa, Ben, and Elaine calling upon internet resources to enrich the whole group discussions with their students. Technology is also being integrated into the final phase of discussion/group

practice/independent practice activity structure as the students work independently to create their own project or presentation. Debbie and Martha encourage their students to use KidPix or other draw applications to create "picture stories," and the other teachers provide their students with opportunities to use Storybook Weaver, as well as ClarisWorks word processing and draw applications, to produce a published product. Additionally, creation of student projects as the culmination of the short-term project-based learning activities the teachers include in their instruction find Stephan, Melissa, Ashley Bob, and Ben suggesting that students use a word processing application for their finished projects or HyperStudio to present information to the group.

How technologies are used to support curriculum

Each of the study participants mentioned the importance of technology tools, especially the Internet, as supplemental resources for supporting curriculum. Debbie explained that having the ability to locate information on a moment's notice has strengthened her curriculum. She elaborates:

> If somebody comes up and says, "What different colors do guinea pigs come in?" and it's something that I don't know, then we will go to the Internet and we'll look up guinea pigs and search and see what we can find to see how many different colors there are.

She further adds that her ability to use the Internet to find information, games, pictures, poetry, songs, and stories that pertain to her units has created a wealth of information accessible at her fingertips that she uses with her students at the mere

mention of a question, plus, “one of the best things the computer does [is] expand their vocabulary” through access to a multitude of software games that she has procured to support the curriculum.

Stephan describes using technology as enrichment for curriculum in that it provides him with access to tools in the room for students to use. He gives the example of using the Internet not only as a great resource for information and activities, but as a tool:

> The three students who had finished their castle stories had nothing to do, so just off the top of my head, I sent them to the library to look up some information, and then they were to create word searches on graph paper. Now, tomorrow, I will call up the Discovery Channel website that lets you make up word searches, and I'll let them take their written word searches and print them out using the word search creator on the Web site.

For Martha, computers in her classroom supplement her curriculum by serving as “an information source through the use of the Internet or other programs like [the] dictionary or story disks.” Ben cites his use of the Internet as a resource for students to do research, and Elaine chose to create a Web Exploration using the Internet as a learning activity so she could provide experiences for her students to search the web and locate information relevant to her curriculum unit in Science. Both Ashley Bob and Melissa have asked for training in how to develop activities that will allow their students to learn the skills necessary to conduct research, using information gathered on the Internet, so that later in the year, the students will be able to use these skills to create a series of research papers required in the writing curriculum.

Why technologies do not support all instructional activities

When asked during the second phase of the study to brainstorm ideas about how they could personally use technology within their classroom on a daily basis, either as a model for the students in the use of technology or with the students using the technology, every one of the participants expressed the opinion that, with access to only three or four computers in the classroom, the only method that could be used to achieve that purpose would be to use the computers in centers with CD-ROMs and other educational software. The participants further expressed the belief that technology was not always the appropriate choice for every activity. Stephan explained his position as being "careful about when we're using technology in the classroom [so] that there is actually a purpose behind it. It's not just putting them on the computer because that's what we're supposed to do." Debbie agrees, citing that "probably the best thing [her students] do with KidPix is blow up things," so when she asks students to draw a picture to keep, she thinks twice about using KidPix. And, as Elaine and Ben found out, students may not have all the skills needed to complete the activity. Elaine tells of her challenging experience with allowing students to use word processing to publish work because the students didn't have any "keyboard skills. So I had to do a lot of one-on-one instruction, and I actually had some 5th graders come in and help them." Ben felt the same way when he tried to demonstrate to two of his students how to use HyperStudio to make a card. He felt that the students were so

engrossed in the interactivity of the application that "they were really thinking this was an activity that they would be able to follow through [from beginning to end], not necessarily [a tool to] create the activity." Melissa and Ashley Bob were surprised by the length of time that creating publications with the use of Storybook Weaver required. Ashley Bob explained, "It took us almost two weeks to get all the stories completed." She explained further that the students spent a great deal of time using the tool to illustrate the stories because the students were exploring all the possibilities that Storybook Weaver had to offer. And, Martha reminds us that computers are only one of the many media available to use with students by adding, "You have to throw in a mixture of [media], the more you see it, hear it, feel it, the better."

THEME #3: THE TEACHERS IN THIS STUDY EXPRESSED THREE REASONS WHY THEY CHOOSE TO ACQUIRE AND INTEGRATE SPECIFIC TECHNOLOGY APPLICATIONS INTO THEIR INSTRUCTION: ACCESS TO MODELING OF THE ACTIVITY OR SKILL BY OTHERS, THEIR PRESENT CURRICULAR NEEDS, AND THEIR OWN PERSONAL INTEREST IN USING THE NEW APPLICATION.

During the second phase of the study, participants were asked to choose what type of technology-enhanced activity they would be interested in learning to develop for use with their own students; the participants then underwent training to learn how to develop the activity and upon completion, implemented the activity into their classroom. When asked why participants selected the activity they had chosen as a means of professional improvement, three common reasons emerged.

First, participants were eager to try applications or activities that they had seen modeled by other teachers in the building, but had been reluctant to give the activity a try without the added support of someone guiding them through the process. In addition, activities that would be useful to the teacher with the curricular units they were using currently often determined the topic and structure for the activity. Finally, their own personal interests were often reflected upon as influencing their choice. For example, Martha explained her decision as stemming from the experience she had the previous year when she had worked with a technology student to develop a website displaying student work, and she wanted to learn how to create that type of application so she could update and maintain as she needed. Her current curricular instruction was thematically focusing on oceans, so she set out to create a Web site that would highlight student publications and pictures they created about the ocean. Debbie had seen how the kindergarten classes in her building had created multimedia stacks with HyperStudio, and she wanted to be able to create activities as needed to support her curriculum. She was currently looking for a means of supplementing her instructional unit on community helpers and felt she could use HyperStudio to create materials that would fill her needs. PowerPoint was the application used by the school technology specialist and project director for presenting information to visitors to the school, and Stephan felt the capabilities of the application would be useful to him personally as a means of stimulating classroom discussion, and

would be appropriate for student use in the presentation of completed projects. Ben wanted to learn to use HyperStudio because he had attended workshops and seen its use modeled there, and felt that the one-on-one training would be the perfect opportunity for him to learn how to use the program. Plus, he could see how effective the application would be to present the connection between continents, countries, and capitals for the community unit currently underway in his class. Ashley Bob had been unable to attend the Storybook Weaver workshop and had seen the colorful products that students in other classrooms had created. She had been working with her students in the writing process and felt that it was time for them to "publish" one of their writings, hopefully with the help of Storybook Weaver. And, Elaine and Melissa were interested in creating activities that would allow students to explore the information accessed via the Internet and use that information to create research reports. However, neither Elaine nor Melissa had seen this activity modeled. Unsure as to the time needed to create such activities, Melissa opted to become partners with Ashley Bob and use Storybook Weaver to publish student written stories. Melissa and Ashley Bob paired up one 3rd grader with a 4th grader for the purpose of writing a story as partners; then, the students would use Storybook Weaver to publish and illustrate their story. Even then, the project ran longer than either teacher anticipated, so they pulled in some of Stephan Lynch's 5th graders who were fluent users of the

application to help the partners get their projects completed. As for Elaine, she forged ahead, creating a Web Exploration that would allow her students to explore the information on the web for animals. Elaine stated that the she was so excited about learning how to do something new and "had hoped that I would learn to be able to do something like this, so when we go onto the ocean or something later on in the year, I could do something kind of like this to tie into that unit." Her excitement at having extended her computer skills in an area of her own personal interest and having a completed product that she could use with her students set her to thinking how she could incorporate the same technique with other topics of study.

THEME #4: THE TEACHERS IN THIS STUDY PERCEIVED THAT TWO DEFICIENCIES, (1) LACK OF TIME TO PLAN, CREATE, AND IMPLEMENT TECHNOLOGICALLY-ENHANCED ACTIVITIES AND (2) LACK OF ADVANCED SKILL TRAINING, WERE SERVING AS BARRIERS IMPEDING THE INTEGRATION OF TECHNOLOGY INTO CLASSROOM USE.

Perhaps, the most surprising finding for this researcher was the emergence of two areas that the participants felt served as barriers to their personal technology integration process. Corazon Elementary School had been chosen as the setting for this study because the school had provided for most of the deficiencies identified in the research as barriers impeding technology integration among teachers. These barriers included access to computers in the classroom, access to a school lab, training with an on-campus support technician, and a

school wide atmosphere conducive to technology use positively supported by administrators and colleagues (Becker, 1994; Hadley & Sheingold, 1993). For the most part, Corazon still provides the collegial, supportive working atmosphere from administrators and other teachers, access to three or more computers in the classrooms, and access to a half time technical support person. The computer lab was dismantled a year ago and computers dispersed to classrooms because of the population growth of the school and the need for the classroom space. However, two other barriers have emerged.

First, participants expressed a wish to use more technologically enhanced activities, but simply feel they do not have the time to incorporate new technology ideas. Melissa describes the lack of time as a process of "more and more responsibility on the school with less and less time . . . too much [to teach] and not enough time." With state mandates shifting much of the emphasis of the instructional time at Corazon to the TAAS test, and district use of Corazon as a model school for the *Principles of Learning*, the participants describe using their time working on Good Work charts, making their classrooms look good for visitors, and creating paperwork to document lesson plans. Martha best expresses the frustrations of the group when she states, "Don't give me paperwork, because I don't have time to waste on that. I just want to work with the kids."

The second barrier, a need for continued advanced training, emerged from conversations with the participants about the value of the one-on-one training

provided during the second phase of the study, was the need for further training. Although all of the study participants have passed the district technology competency, each of them expressed excitement in having the opportunity to learn more. Ben claimed, “I’ve been doing the same things [with technology],” and Elaine stated, “I guess [the school] feels we have a lot of skills and should be able to figure [the integration process] out on our own.” The participants felt that the training was a positive experience and of value because it provided just enough training to allow the teachers to create an activity or instructional design and experiment with implementation in their classrooms. Both Elaine and Ashley Bob commented that with this type of training, they began to think more about the process of not just creating an activity, but how it would be used in the classroom with their students. Debbie, Martha, and Ben added that the convenience of having training that was adjusted to their learning pace and flexible enough to accommodate periods when little time was available for training, was of value, and Melissa expressed an interest, not only in using the skills she learned to apply with Storybook Weaver, but in learning other activities that could be used in her classroom. Stephan found that he was able to explore PowerPoint and create two slideshows within days of his training, and much preferred the thirty-minute demonstration training to a three-hour workshop.

Researcher Reflections and Recommendations

The focus of this inquiry was twofold. First, the research sought to explore beliefs about teaching and learning with seven teachers working in a technology-rich environment, and perceptions about how these beliefs are related to their use of technology in the classroom. Secondly, the teachers participated in an action experiment, a process through which teachers obtained experience creating technologically enhanced instructional designs that supported their stated beliefs about learning and teaching. Therefore, the themes that emerged presented participant perceptions about their teaching and learning beliefs as well as training issues. The purpose of the discussion that follows, regarding the lessons to be learned from the inquiry's findings, is to suggest possible implications for transferability to technology-related professional development for teachers. However, these connections between the findings and the implications contained within this section of reflections and recommendations remain my opinions, and any lessons to be learned from the findings of this inquiry are generally decisions that remain the responsibility of the reader.

PROVIDING TRAINING THAT FOCUSES ON THE USE OF TECHNOLOGY AS A REAL-WORLD TOOL, BUT EMPHASIZES STRUCTURES THAT PROMOTE THE LEARNING INTERESTS OF STUDENTS.

First, the perceptions that these participants shared may be informative to the research that explores how teachers integrate technology into instruction, which has identified several factors that promote the integration process. Included

within this body of research are suggestions that the integration process may be influenced by the acquisition of skills, or stated more descriptively, the more familiar the teacher is with how to use the technology, the more the teacher uses technology in instruction (Becker, 1994; Hadley & Sheingold, 1993). Other research indicates that teachers who prefer learner-centered teaching approaches develop a comfort level with the role of the teacher as a facilitator, not dispenser-of-instruction, and these teachers are more likely to integrate technology into their instruction (Becker, 1994; Cifuentes et al., 1996; Hadley & Sheingold, 1993; Robin & Harris, 1998). Still, other research indicates that those "teachers that embrace adventurous teaching" (Saye, 1998, p. 232) and are willing to incorporate an element of unpredictability in their teaching, or possess a willingness to allow students to control the learning environment (Evans-Andris, 1995b; Howard & Howard, 1994) are more likely to include instructional goals that stress play, exploration, and discovery, within their instruction.

The perceptions of the teachers in this inquiry also suggest that teachers who express a teaching belief that the role of the teacher is to nurture and foster the interests of the child might use the computer more and provide more computer-supported activities, as well as time on the computer, for their students. On the other hand, those teachers viewing the computer as a real-world tool, valuable to the mode of instruction they believe to be best for students only because it allows students to work with real-world tools in the school, might tend

to structure use of the tool as a supporting device for skill learning, hands-on activities, and as a resource for gathering information. The inference from these reflections is that if we, as providers of professional development, want to create an environment in which these teachers, who use technology in limited ways, are able to increase their use of computers with their students and achieve professional growth, we must look to creating training that not only provides these teachers with new and different ways to use technology as a tool, but, at the same time, emphasize structures that promote the learning interests of the students.

For example, most of the teachers in this inquiry voiced an interest in the use of computers as a research tool. By beginning with training that provides the teachers with the skills needed to create a small project such as a Web Exploration, the teachers acquire the skills needed to search the web for appropriate sites, accumulate bookmark lists, create a basic Web page using linking and graphic insertion skills, and working with an .html file from the desktop or a disk. Implementation is simple, as the Web Exploration can be used easily in centers, an activity structure currently in use in the classroom. During this "application exploration" phase, teachers create products they can use with their students successfully and confidently. The next training step could be working with the teacher in creating WebQuests, activities that utilize the web for collaborative, inquiry-based learning experiences. As discussed by Bernie Dodge

in his Web publications illustrating the use of WebQuests, the emphasis is not upon the tool and its use or exploration, but in the task set out for the students—tasks that focus upon the inquiry-based nature of the learning (Dodge, 2000). Using these types of tasks to implement the WebQuest within instruction requires the teacher to focus upon the inquiry-based nature of the activity as well as the collaboration between students necessary for successful implementation. In other words, the teachers would be exposed to a teaching structure that shifts more of the control over the learning process to the student. Thus, the training would succeed in establishing a solid foundation of Internet skills for the teacher, which could then be parlayed into new explorations of how to use the Internet in the classroom, among which, for example, might be the support of research activities such as use of an online "ask the expert" for topic information, or participation in correspondence with subject matter experts in the field via projects such as the Electronic Emissary or NASA's "Internet in the Classroom" projects.

Unfortunately, professional development for teachers stops with the provision of skills sufficient to produce the Web Exploration, and this phenomenon of "learning-to-integrate," the process of providing teachers with opportunities for continuous growth in skills and exposure to new activity structures that not only promote skill-learning, but shift control of the learning activity more to the student, did not appear to be occurring for this group of teachers at the outset of this inquiry. Although the administrators at Corazon

Elementary School have procured grants and training for their teachers and have provided ample access to computers in the classroom, the training appears to have centered its emphasis on how to use the software, rather than how to apply it in the curriculum. Melissa's comment that even though she knows how to use the tools, she doesn't "know how to interpret" the skills into instruction, points to a real lack of understanding in the training process which must be addressed, especially in light of research that indicates that two-thirds of the teachers in public schools share this feeling of inadequate preparation and inability to integrate technology into daily classroom practices (U.S. Department of Education, 2000).

PROVIDING TRAINING THAT FOCUSES ON A CONTINUUM OF "LEARNING-TO-INTEGRATE" THAT MOVES TEACHERS FROM USING TECHNOLOGY AS AN "ENRICHMENT ADD-IN" TO "INTEGRATORS" OF TECHNOLOGY.

The perceptions of the teachers expressed in this inquiry may also inform the issue of creating training that promotes continuous growth in skills in two ways. First, these teachers expressed the perception that technology must be a part of the educational environment of learners, and that it is part of their job to provide their students with educational events that utilize technology. In addition, these teachers have spent the time to acquire basic technology skills and are using technology in the classroom in ways that would identify them as becoming "technologically competent" (Lowther et al., 1998; Morrison et al., 1999). Yet, when asked how they felt they could incorporate technology on a daily basis in

their classrooms, each of them responded that incorporation on a daily basis could only be accomplished with students rotating through centers with educational software. The knowledge of how to integrate technology in a variety of ways, subject areas, and according to different instructional structures appears to be lacking, even for those teachers interviewed who expressed student-centered teaching philosophies. Perhaps we need to re-define our expectations and training emphases from an acquisition of skills to acquisition of "integration," in which skills are acquired as a means of accomplishing the technological enhancement of the instructional objective. Further research regarding methods used to bridge the transition from "tool knowledge" to using tools in instruction in ways that teachers deem valuable might provide insights for those interested in the best ways to help teachers integrate use of technology in curriculum-based ways.

Secondly, the perceptions of these teachers that technology must be a part of the educational environment of learners, but is not appropriate for all instruction supports conclusions that have been drawn in other research that explores teachers' beliefs about teaching and learning. Teachers use innovations that they perceive as providing an added value to their teaching (Eisenhart et al., 1988) and assisting in helping them achieve instructional objectives they define as worthy (Orton, 1996; Saye, 1998). The teachers in this inquiry are using certain activity structures, which I identified in the theme section as their perceptions of the best ways to teach, and perceive technology use that supports these structures

as serving a valid instructional use. This limitation placed on the use of technology to certain activities is explained by Hadley and Sheingold (1993) as the result of the amount of experience a teacher has had using computers in the classroom in that "initial practices and approaches tend to be similar to familiar well-structured classroom technologies (e.g., the workbook)—more focused on reinforcing directly what is already being taught or, for particular groups of students, providing special opportunities" (p. 279). The authors continue to explain that, in their survey of technologically-competent teachers who were using technology on a daily basis in the classroom, when teachers become more comfortable with the process of using technology in instruction, these practices are used less and less in favor of more self-generated learning approaches.

Rogers (2000) would classify the teachers consulted for this study as being on a step two adoption level as described by a three-step adoption process through which teachers progress, in which first, teachers use technology as personal productivity aids that help with accomplishment of tasks more effectively and efficiently. Secondly, teachers progress to using technology as a form of "enrichment add-in" that "inject[s] new materials into the 'old' teaching and learning without changing the basic mode of instruction," followed by a final stage in which teachers "reconfigure teaching and learning activities to take full advantage of new technology"(p. 21).

To move teachers from these early adoption stages to a more integrated use of technology, the results of this inquiry suggest that training should include several components. First, the participants expressed a desire to learn to use technologies whose use in the classroom they had seen extensively modeled, either by other teachers, trainers, student teachers, or students. In addition, the use of training to support their immediate curricular needs was also valued. David Dwyer, in an online interview regarding the state of technology integration in the schools, described the teachers participating in the Apple Classrooms Of Tomorrow project as learning from others in a similar fashion:

> When a new group of teachers came in, progress [with technology integration] was much more rapid. When we interviewed them, they said it was because they could watch and learn from others. The fear was gone because they felt confident that "if they can do it, so can I." This led us to some ideas about staff development. There are real benefits to being able to see other teachers use the technology, and realize, "Aha, this is what it's for." The collegiality allowed countless numbers of "30 second workshops" to take place" (Salpeter, 1998).

Secondly, accommodation of personal interest by allowing the individual to select technology tools with which to work was perceived by the participants as increasing the value of the training. Sherry, Billig, Travalin, and Gibson (2000) suggest that this could be viewed as one of many effective strategies useful in encouraging teachers to acquire new technology skills, and Koehler (2000) would describe a "professional development experience [that centers] on a curriculum-based activities of [the individual's] own choosing" (p. 12) as common sense (Koehler, 2000).

Thus, because these teachers expressed the belief that it is part of their role to provide their students with educational experiences that are enhanced by technology, but that technologically-enhanced instruction was limited in their minds to certain uses and activity structures, professional development for these teachers should provide knowledge about how technology is integrated in a variety of ways, pertinent to the different content areas, and presented using a variety of structures, in such a way as to encourage growth along a continuum of "learning-to-integrate."

PROVIDING INNOVATIVE TRAINING STRUCTURES THAT ADDRESS THE TIME ISSUES AND ADVANCED TRAINING NEEDS OF TEACHER.

And finally, the research that investigates how teachers integrate technology into instruction may be informed by the perceptions that these teachers shared regarding events that appear to serve as impediments to their continued successful integration of technology: lack of time to develop technologically enhanced instruction and lack of continued access to advanced training.

Lack of time to acquire skills and develop instructional designs has been identified by Collinson and Cook (2000) as one of the key time issues in teacher expression of feeling overwhelmed with their jobs. The participants in this inquiry shared that the value of the training session of the inquiry was that it was flexible enough to accommodate the changing schedules and time constraints

inherent in the elementary school day, while allowing participants the chance to learn in an enjoyable, relaxing environment. Innovative methods that provide teachers with time to learn and share with colleagues need to be explored. For example, recruiting university students who are completing technology-enhanced instructional designs in their university coursework to come into individual teachers' classrooms for the purpose of working with the students and providing mini-workshops for the teacher could provide teachers with opportunities to see new technology techniques being modeled and used with students.

Another method of providing time and advanced training for teachers might be accommodated at Corazon Elementary School as an outgrowth of the specialists that the school routinely provides its teachers through grants. The school already provides its teachers with a full time project director who procures grants for training and program support, a full time curriculum specialist, and a part-time computer technician. Adding a support person to this educational situation whose purpose is to provide integration training to the teachers, and procuring grants to support stipends for teacher participation in the training on a regular basis might be an additional approach for providing the teachers at Corazon Elementary School with integration training. Although most school budgets may not encourage this type of innovation, the value of this type of specialist with the flexibility to work with teachers during school hours as well as after hours and Saturdays, in small groups or one-on-one, to incorporate the

methods these teachers perceived as valuable in training, might be a worthwhile investigation. A fresh look at how we structure training may be required to create the continuity needed for professional growth and provide the assurance that teachers are building upon existing skills and expanding their understanding of how to use technologies to support and enhance instruction along a continuum of "learning-to-integrate."

Summary

In summary, the purpose of this inquiry was not to provide findings that are representative of all teachers, but to explore the simultaneously shaping influences that were dependent upon and unique to the context of this inquiry, namely the phenomena that were lived by these seven teachers working in a technologically-rich learning environment. The reader must decide if a look into the worlds of these teachers as they reflect upon the beliefs that influence their teaching, learning, and efforts to incorporate technology into their instruction will provide meanings and insights that are valuable to the reader's own teaching and learning experiences. The lessons to be learned from this inquiry into the experiences and perceptions of the seven teachers who served as participants in this investigation may indicate to those readers that professional development and technology training for teachers and preservice teachers could be informed by assuring the provision of the following:

- Skill training that focuses on the use of technology as a real-world tool, but makes accommodations for student interest;
- Development of technologically enhanced activities that fit the teacher's curriculum-based practices;
- Models of successful uses of technology integration in the classroom;
- Technical training that emphasizes choice of technology tools;
- Use of mini-lessons or just-in-time training to accommodate the time challenges of teachers;
- Continued access to advanced training that provides a continuum of "learning-to-integrate."

If we, as those who provide professional development and technology training for teachers, state that our goal is to encourage the development of teachers who use technology tools to enhance instruction, we must realize that first, integration is a complex process that is different for every teacher, and that secondly, beliefs about teaching and learning are related to the ways a teacher uses technology in the classroom in very different and personal ways. "One size fits all" training may be appropriate for skill acquisition; but for integration assistance, we need to provide teachers with innovative and flexible training structures. We need further exploration into the methods that teachers deem valuable for enabling them to move from "using tools" to

"integrating tool use into students' instruction." And, we need to investigate how to provide a continuum of "learning-to-integrate" so that teachers expand their own methods for designing and delivering instruction, using new activity structures that nurture and foster the interests of students.

APPENDICES

Appendix A: Researcher as Instrument Statement

Researcher as Instrument Statement

A Story

I had recently completed the automation of our East Austin elementary school library. The school was known in Austin as an innovative teaching environment for difficult children, and today, I had arrived at school ecstatic that finally the computer monitors for the automated system would be installed. On this day, I witnessed the motivational power of technology in the classroom. As quickly as the first monitor was hooked up, the kids swarmed all over the machine. And, those children, many of whom had severe reading difficulties, were fascinated by that ugly green text presented on the screen. As first, I nonchalantly attributed their interest to the novelty of the computers, but time went by. Even after a couple of years, students continuously expended great effort to acquire the information that could be gleaned from that ugly green text on the screen.

During these same years, I had purchased a computer for my own household, and found that my youngest son, who still to this day believes assigned literature readings all start with the title "Cliff Notes," began to become very interested in learning new computer programs and downloading files from the Internet. I was amazed to find that in a few short months, his reading skills had improved dramatically. The comprehension skills required for this type of technical reading had boosted his reading almost three levels.

I became convinced then that technology motivates different learners in positive, yet different, ways, and I still believe today that technology should be available to every classroom teacher.

Very often, we find that, in our personal lives, it only takes a few experiences to shape the foundation for our deepest beliefs and strongest values. Therefore, I will describe three contexts in which multiple experiences in my life have led to the construction of deep-held beliefs that could become influential as I choose research topics to explore, develop designs for studies, manage the collection of data, and rely upon my own interpretations of such data in order to draw conclusions.

Teaching and Learning

I come from a long line of Southern teachers. My great-grandmother was a teacher; my grandmother was a teacher; my aunts, uncles, and cousins were all

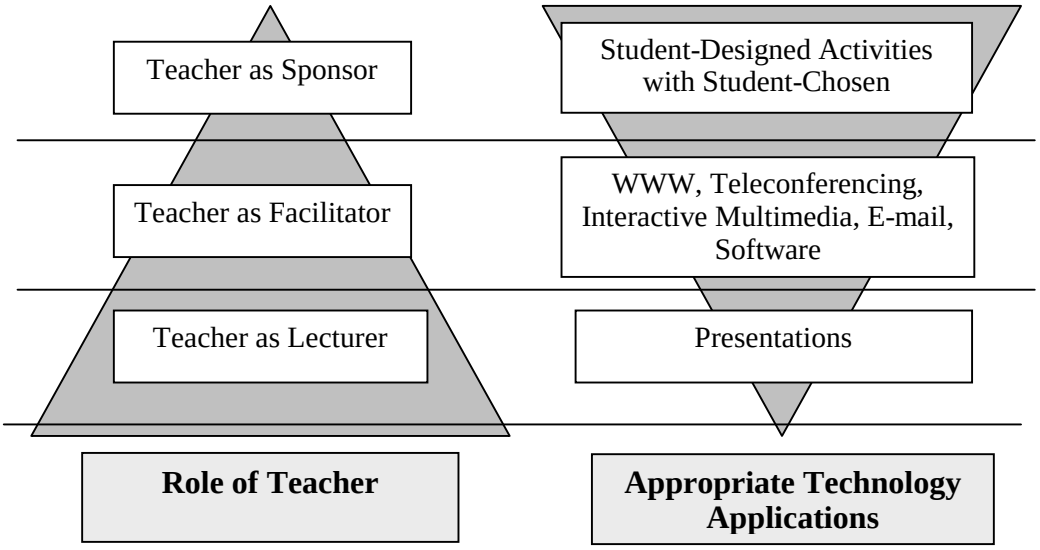
teachers; and my parents were teachers. I have always wanted to be a teacher, and I intend to teach until I turn over the torch to the next generation. I have taught for sixteen years ("officially" counted by the State of Texas) as a 5th and 6th grade teacher, all-level Music teacher, all-level Librarian, and Primary Reading Teacher. The remaining seven years were spent as a substitute teacher, a homebound teacher, and a parent classroom teacher. My belief as to the characteristics and qualities that a "good" teacher must embody has been shaped by the many years I have spent in the classroom, as well as the values passed down to me through the generations of teachers in my family. I believe that any teacher "worth her salt" provides a learning environment that promotes active, student-constructed learning in a secure, nurturing environment, structures activities that are relevant to the student, assesses these activities fairly and according to standards that are acceptable to student and teacher, and demonstrates enthusiasm in sharing the content and learning experience with the students. I believe that a good teacher is a life-long learner and enthusiastically encourages others to pursue learning for the enjoyment of learning.

These standards that I have established as criteria for excellence in teaching fit in nicely with my field of instructional technology. My experiences as a teaching assistant for the basic computing skills class (that must be taken by all education majors before they begin their student teaching block methods courses) have only strengthened my standards. I have come to believe that teachers who invite their students into the discipline by promoting an apprenticeship relationship ensure their deeper processing of the physical and cognitive aspects of working with computers. I deeply believe that students learn the skills associated with this field best when immersed into this apprenticeship in which the teacher serves as a facilitator, rather than expert. We all have life experiences to share. Some of us just happen to have *more* experiences to share!

Role of the Teacher in Curricular Integration of Technology

Reports from the field bemoan the fact that educators have access to such wonderful technologies today, and yet so few teachers actually integrate technology into the curriculum. I believe that this harsh judgment comes from a lack of a definition of the term "integration." If "integration" means utilizing technology to teach every subject or content, then few teachers will meet this goal. However, if true "curricular integration" means selecting the right tool to meet the instructional needs of the students, and technology-based tools are chosen to enhance learning only when they are the appropriate choice for the job, then, I believe that teachers in the field have been quite successful in using all modes of technology, including graphing calculators, video, laser disks, computer programs, web-based instructions, teleconferencing, and interactive multimedia, to present curriculum in the classroom.

I also believe that how the teacher views his or her role as the instructor influences the actual depth of integration of technology. As a participant in a group project this summer, we devised a visual that depicts the limitations of technology integration based upon the instructor's view of his or her role in the delivery of instruction. At the bottom of the pyramid, we find a teacher who views the instructional role as that of "filling empty vessels known as students with knowledge." This teacher will rely upon lecture as a primary mode of instruction, and there will be little available time for the integration of technology into this style of teaching, except for perhaps presentation modes such as PowerPoint or Authorware. The teacher who views the instructional role as that of a "facilitator" (the middle of the pyramid) will design activities that allow the student to explore many technologies, such as intranets, interactive multimedia, teleconferencing and telecommunications, internet and web-based instructions, plus integration of many other software packages. In this view, the teacher integrates technology based upon student and curricular needs. And, the instructor who views his role in instruction as sponsoring the students as they choose their independent projects and technologies sits at the top of the pyramid as teacher as sponsor. Students choose technologies based on their predictions of need rather than because of any teacher direction.



I believe that the role of the teacher, especially for K-12 and undergraduate students, should be classified as "middle-pyramid" and should revolve around the student and curricular needs. Therefore, curricular integration

would occur often, within a variety of contexts, and utilizing a variety of technologies as deemed appropriate by the teacher and/or students. The key to curricular integration is the ability of the teacher to adjust to the role and teaching style that will best promote the use of technology within the curriculum.

Technology -- Pervasive Necessity

And, finally, why should we even bother with technology? We have educated our students for hundreds of years without technology, why now? In addition, there are many other perfectly good ways to teach that do not require the expense, the hassle that comes with maintaining complicated and quickly evolving technology, or the time factor needed for training and implementing such a program. It is my firm belief that technology, especially computer technology, is changing the very structure of our social culture, much as the industrialization of car manufacturing did earlier in our history. The invention of the car did not alter our society, but the advent of easy access to cars through assembly-line manufacturing changed the social fabric of our society. Cars have become such a pervasive part of our culture that historians often refer to the "American love affair with cars." I believe that the pervasiveness of computerized components which control many of the tools that direct and dictate our daily lives (such as alarm clocks, stoves, televisions, cars, banking, shopping, etc.) and the accessibility to instant communication are only part of the revolution. As access to a personal computer becomes easier and within reach of a majority of families, we can almost envision a paperless society! It is my firm belief that it is the responsibility of educators around the world to prepare our students to participate in this global revolution, and the revolution could start with future teachers.

Contexts to Research

I would like to explore areas of research that would relate the contexts of quality teaching/nature of learning, the role of the teacher in integrating technology, and preparing our future faculty to utilize the technology that is beginning to pervade our daily lives. I am interested in questions such as:

- What is the process that student teachers go though to develop as teachers who integrate technology into their daily curricular instruction?
- Are student teachers entering their field experiences with the experiences to integrate technology into curriculum, or do they just possess computer skills? Are computer skills enough to lead them to integration?
- What is the current state of integrating technology into our public schools? What are student teachers finding when they enter the public schools? How does this differ from what they expected? What can be done to close the gap between expected and reality?
- Why do teachers use technology? Why are some more motivated than others to incorporate technology within their curricular instruction?

Based upon the contexts that I bring to these explorations, I would expect to find that student teachers will feel that they are prepared to work with computers, but are unable to actually create learning situations that promote active learning and integrate technology because they have never seen these types of instruction modeled. Perhaps, I will find the frustrations so prevalent in the beginning experiences of new computer users also prevalent in these student teachers' experiences with integrating the technology into their daily curricular instruction.

I would also be willing to discover student teachers who felt that the computer skills provided by their education was sufficient to motivate them to integration, if I could document this integration through observation or lesson plan documentation. However, I believe so strongly that teachers must learn to utilize technology in order to prepare students for the future that I would be unwilling to discover that teachers and student teachers were not utilizing technology simply because there are other ways (lower tech, lower cost) to implement the instruction. I believe strongly that if technology is the appropriate tool for the student and curricular need, then that technology should be integrated regardless of the accessibility of other methods.

I would hope that any revelations from exploring such questions would further our understanding of the relationship between technology integration and an active learning process, first by the student teachers or teachers as they go through the process of developing integration techniques, and secondly by the students as they receive the benefits of the integrated instruction. Perhaps, the results can be used to adjust our training techniques for student teachers and teachers, or provide insight into adjusting teaching styles that would enable teachers to further integrate technology. Perhaps, the results will point to additional research that could be conducted with students and their learning relationship with a teacher who utilizes technology integration.

Why Use Naturalistic Inquiry For This Topic?

Many research studies in the field of instructional technology compare the new, computerized way of instruction with the old paper and pencil methods, which is, as a friend of mine often states, "like comparing apples to oranges." In working with computers, the learner goes through a process which is very personal and varies significantly from individual to individual. I believe that this process needs to be documented, not in numbers and measures, but with narratives and personal revelations. Integrating technology into a personal teaching curriculum depends upon the individual's perception of integration, teaching style preferences, prior knowledge of computer skills, and a vast array of other individual preferences and perceptions. I believe that only a naturalistic inquiry allows the informants to engage in personal inquiry, reflection, and communication about integration. Naturalistic inquiry can document any changes or common ground between informants which could be a useful foundation for

explaining the process teachers and student teachers undergo as they increase their computer skills and knowledge of the uses of technology as a tool to implement curriculum.

Appendix B: Samples of Member Checking

LEVEL 1 MEMBER CHECKING

9/6/00 Interview: Second Grade Participant

Q: So really just whatever you want to tell me about your teaching beliefs is what we're going to start with.

A: Okay. Well, it's so hard.

Q: I know. We've got to change gears here. You've been working hard, working hard.

A: I know.

Q: Now you've got to stop. It's kind of hard.

A: Well, I believe that each child should be given an equal opportunity in school.

Q: Okay.

A: And/or an equal opportunity to learn. I really try to gear my classroom and Language Arts and stuff so that I'm having smaller groups, and I can really kind of get to all of the kids. I don't really like to do stuff where they're all doing it. I mean, they're all doing the same stuff, but I really want to take the time to try to meet with them just so they're all on the same page, I guess. I feel like a lot of times it's real easy for them to get lost. It's hard, because there's such a huge gap. You know, I have some really high kids and really low kids. I really try to put the kids in a position where they're going to get the most out of their learning. If they're reading on a high level, then my gosh, they can be on 3rd Grade books, you know, higher materials. I did it for the first time last year, and I had kids reading 4th Grade books. And it was just fun.

Q: Okay.

A: You know, we'd all be working on character and main ideas and stuff, but they would just be more challenged. So I guess what I mean is I try to get the most out of my time with them. Not really the most out of my time, but try to push them a little bit further than... I don't know.

Q: [Laughs.] That's okay.

A: This is sounding so funny.

Q: No, it really isn't. What you've told me so far... And I'll do this a lot.

A: Good.

Q: When we stop, I'll review it.

A: Because it's all so mumbled in my mind.

Q: And then we'll go over it. Well, this is the process we go through.

A: Okay.

Q: It's called member checking, because what I'm going to do is just document what you're telling me.

A: Okay.

Q: So it has to come out and it has to sound like you.

A: Right.

Q: So I'll actually use a lot of your quotes and things in it.

A: Okay.

Q: I just want to be sure that I'm understanding what you're saying.

A: Okay.

Q: But I think what you've told me so far is that you feel like your children that are in your care should be given equal opportunity to learn.
[Both laugh.]

A: Yeah, that sounds better.

Q: And you kind of gear your classroom using smaller groups. You meet with smaller groups. You try to keep them all on the same page. And because you have a severe gap between the highs and the lows --

A: Yes, yes.

Q: -- you really have to watch out for that.

A: Uh-huh.

Q: And one of the ways that you do that is that you provide... They may be doing the same type of activity, but maybe with different materials.

A: Right.

Q: Like your 3rd and 4th Grade readers are reading out of 3rd and 4th Grade reading material.

A: Right.

Q: But they are kind of doing the same type of thing.

A: Right.

Q: And you like to push them farther.

A: Uh-huh.: Sounds good.

Q: So ....?

A: I was thinking, you know, like in Math or something, you know, always giving them the opportunity to use manipulatives if they need to. But kind of letting them know that eventually we want to get off of that. But if they still need to use them or whatever, that's fine. But you know, we can even be doing the same problem, but you know, showing a lot of different possible solutions on how to get to the answer, but not that the answer is like the most important thing. It's more important how they are thinking it through in their head. The higher level kids have different strategies than the lower kids, but we share them all. They are all fine strategies.

I guess that kind of goes the same with like the Language Arts aspect of reading group and centers and stuff like that. They are all doing the same ... basically the same thing, but just so that those little kids aren't just getting totally lost. [Laughs.]

Q: Yeah. [Laughs.]

A: Right. . I think that does happen a lot. It's hard, because then there are those kids that are like the... They're not Special Ed, because they're like those slow learners or whatever you call them.

Q: Uh-huh.

A: Like it's so easy to just kind of... It's hard. It's frustrating.

Q: Well, you've got a gap with a lot of really high and a lot of really low and there's not much middle.

A: Right. Right.

Q: Is that what you're saying?

A: Well, this year I have a lot of middle, and some high, and some low. But last year I had more highs and lows and not quite as many in the middle. Last year I had a lot of that. I learned a lot last year with my class. I learned how to work in those smaller groups. It was real interesting. It was such a great class. It was great.

Q: And so this year you have a lot of middles and a few highs and a few lows.

A: Uh-huh. Uh-huh. A lot of middles, which is great, you know. Middle being they're a little bit even higher than they need to be just by one or two reading levels.

Q: Oh, okay.

A: So that's good. They left 1st Grade in a good place.

[Both laugh.]

Q: Okay. So we've talked a little bit about some of the way that you structure your activity so that you can keep everybody with an equal opportunity to learn.

A: Uh-huh.

Q: Is there something you'd like to add to that?

A: As far as going on this equal opportunity?

Q: If you'd like, uh-huh. Or even to any of the things that you've said so far -- the smaller groups, getting the most out of their time using different materials.

A: Uh-huh. Well, this is kind of a little bit different, but I think one of the things that I enjoy most in teaching -- and this is -- I don't know if this is a philosophy -- I don't really know -- is I love to read to my kids. I love it. So I'm hoping that... I mean, I read to them twice a day, you know. So I'm hoping that them seeing me enjoy reading so much that they'll take that with them and think, "Oh, well, I want to read because these books are so fun." Not like, "Oh, gosh! Reading!" Because I just feel like in 2nd Grade that is the most important thing. Even in Math, if they cannot read, then they cannot do anything independently. Then they have to have a partner or something. And I haven't really had too many kids that don't like to read. I just think that they still like to listen to stories and stuff, but I just think it's so important to read to kids every single day.

Q: Sure.

A: I read them a chapter book every day. That's good, because it's harder for them. It's too hard for some of them to read, but then they're doing these whole mental illustrations. But I still read like Hop on Pop and stuff. I read them everything, because I love to read too.

Q: Okay. So we've talked a little bit about... You've been telling me about how you enjoy reading with your students. You want them to see how much you enjoy reading so that they will enjoy reading.

A: Uh-huh.

Q: And you feel it's very important to read to them every day and that the reading is very, very critical to this 2nd Grade --

A: Right.

Q: -- curriculum? [Laughs.] You didn't say that. I don't even know what you call it. To 2nd graders, that's just a real important skill for them to learn.

A: Right.

Q: It's not really curriculum. It's just something they've got to learn to do.

A: Right.

Q: Okay. Are there other areas? Tell me some more about...

A: Well, I try as much ... like we have them in centers and stuff. And I really like them to work independently and try to have some kind of hands-on activities, which sounds so, you know, "They learn with hands-on stuff.".
Because then I think also then there are different learning styles. They'll kind of show me. Like, for instance, if we're doing like a math worksheet or something like that, which I usually send those home for homework. But if we're doing something, instead of them just trying to add 2 + 1 or something, [I'd say], "Show me how you would do 9 + 8. Would you start at 1 and go to 9 and then count 8 more on? Or would you already have your 9 and go 10, 11?" You know, like the counting on stuff. I think it's neat to use manipulatives just to see how their learning strategy is at that point. Does that make sense at all?

Q: Uh-huh. Sure.

A: Just trying to have them do more of the work and not me talking all the time.

Q: Uh-huh.

A: And that still happens too much. [Both laugh.] I'm trying to think if there is anything else. I'm like touching on every single thing right now.

Q: That's what I need for you to do, because these are things that are important to you.

A: Yeah. And I really, really want my parents to feel comfortable in my room.

Q: Okay. Would you like to tell me more about parent involvement then?

A: Well, I feel like everything I'm saying is so like such a teacher. Do I have a life? No, I don't have.

Q: [laughs].

A: Okay. Well, I think it's important for parents to feel like that they are needed in school and that they do have certain responsibilities, etc. But also I want them to feel like that they can just drop in any time, and they're not going to hear me say, "Oh, my gosh! So-and-so is having such a bad day today." I want to try to be more positive. And it's something that I really want to work on this year is calling

them on the good stuff. "Your daughter had such a great day." "I was really proud of them." Because obviously the more phone calls and stuff are about negative behaviors, and it probably will be for a long time. It's just such a normal thing to call about when there's a problem.

Q: Sure.

A: I think the more that I can get parents into our school and stuff that they will see what hard work it is. I think it's probably really intimidating to come into a school and to even begin with volunteering and stuff. But if you can get support from parents and you're both working together, the result is going to be so much better for the child. Support coming in and reading to them, or helping out with centers or field trips, copying stuff, helping out in any way, just coming and eating lunch with their kid, anything. It can be really non-committal, just whenever, or it can be... I don't know, because I think that helps the kids so much, too. Like, "Oh, my gosh! My mom is coming today!" It's so fun. But I think that's really important -- the parents.

Q: What you've told me about parent involvement is that you want the parents to feel that they are needed in school and that they have a responsibility, and yet you want them to feel very comfortable to come in at any time.

A: Uh-huh.

Q: And you have made an effort this year to call about the good stuff.

A: Uh-huh.

Q: Making your phone calls positive. And with support from the parents working with you, then the result is better for the child. This help can be in a lot of different ways. It can be with field trips, eating lunch, reading books. Just --

A: Anything.

Q: -- anything. Just participating in the school.

A: Uh-huh. Yeah.

Q: Okay.

A: Participating in the school in any way. Carnival. PTA.

Q: Let's look back real quick. We've talked about an equal opportunity to learn is real important in your classroom. And you do this with smaller groups, meeting with smaller groups, and trying to keep the students learning either the same activities, the same skills, but not necessarily with the same materials. You will individualize that with materials. Another important thing for you is that they enjoy reading. It's really important that they see you enjoy reading, because you want to be a model for them to see that --

A: Uh-huh.

Q: -- they can enjoy reading too, and maybe they'll want to learn to read if they see how much you enjoy reading. And a lot of times this comes out... Let's see. No, no, no. You like for your students to work independently. Your room is organized in centers.

A: Uh-huh.

Q: Am I saying that right?

A: Centers in Language Arts, uh-huh.

Q: Centers, okay. And with lots of hands-on activities, and you emphasize sharing strategies with manipulatives or just how problems are solved, so that the students are doing more of the work.

A: Right.

Q: And they are taking responsibility for the work. And another component is that you think the parents should be involved. You think that's real important. That they are needed in school and it's better. As long as you're working together with the parents, you feel like that it will support the children and help them to have a better learning environment.

A: That sounds good.

Q: You want to add anything to it?

A: I can't think of anything else. I feel like I could talk so much.

[Both laugh.]

Q: That's okay.

A: But that sounds so good.

Q: That's okay. Well, what we'll do is we will write it up like this.

A: Okay.

Q: And then you will make your reflections into your tape.

A: Okay.

Q: And then we'll start putting it all together.

A: Okay. Do you want my reflections to kind of be based on what I've told you here today?

Q: Right now, we're just talking about your teaching beliefs. We're reflecting on your teaching beliefs, so that's fine.

[End of interview.]

LEVEL 2 MEMBER CHECKING

9/13/00 Interview: Second Grade Participant

Q: This is just the summary. It will not be this condensed whenever it gets written out. I wanted to be sure that I understood what we talked about last time.

A: Okay.

Q: This is another form of member checking. I'm supposed to do it three times. We do it while we're talking. Then after we talk, I summarize it and go back over the summary with you.

A: Uh-huh.

Q: And then the third time is whenever I get it written, I'll get you to review it for me.

A: Okay.

Q: Then whenever I actually get everything all put together, I'll probably ask you to read it again and make sure that it makes sense to you.

A: Okay. Great.

Q: And that it sounds like you. And that you're comfortable with everything that's been said. [Laughs.]

A: Right. Yeah. [Laughs.]

Q: Because a lot of times we say things in confidence and we don't really want it to go other places.

A: Right.

Q: So since we're talking off the top of our head, a lot of things come out.

A: Right.

Q: So if you get sensitive about things that are being used, we can always take them out.

A: Okay. I don't think I will be, but it's nice to have the option...

Q: . But when we talked last time, you were telling me your beliefs about teaching and learning. What I did was I kind of broke it into three areas: your role as a teacher, the role of the students in your classroom, --

A: Oh, good.

Q: -- and the role of the parents.

A: Oh, that's nice.

Q: So I'm just kind of categorizing them for you.

A: Yeah.

Q: If that's okay.

A: It was so jumbled last time.

Q: Well, and that's what happens. You're just doing it off the top of your head.

A: Oh, good.

Q: It's stream of consciousness almost is what we're doing. But under role as a teacher, your key thing was that your job was to give each child an equal opportunity to learn.

A: Uh-huh.

Q: And you gear your classroom to accommodate various learning styles.

A: Great.

Q: Some of the ways that you do this is the use of smaller instructional groups.

A: Okay.

Q: And then you make an effort to push them to their potential. An example that you gave me was that like in Math, your students are doing the same types of activities, but they may be using different resources. Some will use manipulatives. Some will be beyond that stage --

A: Right.

Q: -- and will be using symbols. And it doesn't matter, because you all share all of those strategies that they are using. But you encourage them to use what they can.

A: Great. Yeah, sharing strategies. [Laughs.]

Q: Sharing strategies.

A: Uh-huh.

Q: And another thing that you do is you use modeling to encourage love of reading.

A: Uh-huh.

Q: You believe reading is the most important skill for second graders to learn and you love to read. So you read twice a day with your students, and hope that if your students see you enjoying reading, they will also want to read.

A: Right.

Q: So modeling is a big part of how you do this.

A: Uh-huh.

Q: And then you use centers, which gives students opportunities to work independently and with hands-on activities. And another way that you accommodate all these different learning styles and everything is by providing positive feedback through phone calls to parents and encouraging parents to feel comfortable dropping in and participating in their child's education. So that was kind of what I put in as how you view your role as a teacher.

A: Uh-huh.

Q: And then for the students, you use a lot of independent activities so that the students do more of the work, rather than listening to the teacher talk all the time. Because the important thing was that you used a lot of independent activities so the students were doing the work.

A: Right.

Q: And that's what you felt that their role was, was to be able to do most of the work.

A: Right.

Q: Then you also talked a lot about the role of the parent and their job. That the parents were needed in the schools in many ways, lunch, carnivals, PTA, field trips.

A: Right.

Q: But you felt that with support from parents working together with the teacher and students, that the result was a better learning environment.

A: Right.

Q: Okay. That just briefly summarizes what we've talked about. Is there anything that you would like to add to any of this at this point?

A: No. I think it...

Q: If there is anything that you want to just add generally to these, we can do that.

A: Okay. I think it all sounds pretty good.

LEVEL 3 MEMBER CHECKING

Q: You've had time to review the case study? Do you think we need to make changes, or does it fit with your ideas?

A: Oh, yes, I didn't make any changes to the paper. Do you want it back?

Q: Oh, no, not unless you made specific changes. Do you think it sounds like you?

A: Yes, it seemed to flow pretty well.

Q: Were you comfortable with everything said, or do we need to work on some of the areas?

A: No, it sounds pretty good.

Appendix C: Document Samples

TEACHING PHILOSOPHY SAMPLE

Summary: Teaching Beliefs of Stephan Lynch

Role of the teacher:
As a student teacher, Stephan saw two types of teaching. The first way of teaching had the teacher stand up and tell the students information; the class was structured around the teacher and all the students were expected to act and learn the same...all were "crammed into a shell." Stephan believes that the teacher sets the structure, expectations, and goals, but the teacher may not be the only source for those goals/expectations. Teacher sets parameters and then facilitates the educational process of the students.

Stephan also believes it is important to have people who want to help kids be kids and also learners. (This may be shown in the teacher attending games and other student activities when possible.)

As a teacher, Stephan believes that he must have high expectations for students, but be sure students are not only understanding what they are doing, but why in the learning process. This is demonstrated in his instruction by establishing clear expectations and making sure students know expectations before beginning instruction (Good Work charts).

Role of student:
Students are responsible for their own education. Students must learn what they are supposed to learn and take responsibility for doing their part in their education. Education is their job.

Design of instruction:
Stephan believes it is his role as the teacher to establish parameters. Although his lesson plans may be sketchy, he has a picture in mind of where "I want to be" at the end of the activity. (EX: Legend stories) Much of the discussion is determined by the interests of the students and the questions they pose during the instruction. Stephan provides a variety of structures (sometimes very structured, sometimes not so structured) so that spur of the moment things may be explored. (EX: Indian culture/gang culture)

Tying instruction to real world applications as much as possible is important.

TEKS are a great service and if Stephan has done his job, the students will do well on TAAS.

Organization also supports establishing expectations. Weekly lesson plans are created once a week in grade level meetings. Together the grade level uses the TEKS timeline (a yearlong timeline established previously by the grade level which outlines the TEKS objectives by week for the 5th grade curriculum in Math, Reading, and Writing). From that outline, individual teachers design activities that will accomplish these objectives and continue the content/projects/other instructional goals that are occurring in the teacher's classroom. These activities are somewhat driven by personality of the teacher and the interests of the students in that teacher's class.

PROFESSIONAL DEVELOPMENT PLAN SAMPLE

Professional Development Plan for Stephan Lynch

How using computers now:
Personally uses word processing (progress reports), database for TEKS/TAAS skills, email, digital camera, Student use: publication of student work in ClarisWorks, Internet resources as needed to support student learning, Storybook Weaver to publish student writing, online crossword puzzle maker

How to incorporate on daily basis:
Would like to use centers to teach keyboarding skills to support/improve publication process of student work and wants to incorporate using presentation tools in his instruction.

Professional Development Plan:
Need/Want: Wants to learn to use PowerPoint for purposes of modeling application for students and presenting them with an additional choice for presentation of projects and/or publication needs. Plus, will set up *Type to Learn* application on computers, so students can rotate through the program on a consistent basis.

Plan for Personal Professional Development:
1) Resource person will demonstrate how to use PowerPoint.
2) Stephan will create a couple of PowerPoint presentations to use in his instruction while he is mastering the skills. Resource person available as needed.
3) Will use in instruction first, as a means of reviewing vocabulary for the science unit on landforms. He plans to clip pictures from the web and use those pictures to review vocabulary. We will talk more about other uses after he has had some time to experiment with the capabilities of the application.

Appendix D: Field Note Samples

9/28/00: Observation of Kindergarten Classroom

When I walk in, the students are involved in their opening group work. They are reading around the room, which means they go around the room reading different charts and things that are up on the wall. Right now, they are reading out the sounds first in Spanish and then in English.

While they are doing that, I'm observing the room. This room is such an invitation for children and learning. Everywhere you look, there are colorful things that the students would be interested in using, and playing with, and investigating, and exploring. The Reading Center is set up like a stage. It says, "Learning is Fun." Books are set up/displayed in very colorful stage. There's a Math Center, a Math Zone that has puzzles and the Problem of the Day.

But right now, the students are using a pointer to read items on the board. They take turns. First it's the alphabets and then there are sentences that they read through. The sentences are contained in a pocket chart. The sentences have the children's names with pictures. The sentences are first read in English and then in Spanish.

Looking further around the room, there is a Housekeeping Center, which is surrounded by Listening Center, globes, blocks. Now the children are counting. There is a counting chart, pocket chart set up. The teacher takes out enough numbers ... one number for every child. As they are sitting quietly, when they finally get quiet and settled, she hands them a number. Then she calls them by number, free choice, to go to their centers and the children are allowed to go to their centers.

The computers fill up very quickly. There are six children working at computers. The first student who gets there goes to click on a Hyper Studio stack of dinosaurs. When it opens up, he decided he doesn't want to do that. Then he goes up to the 'Edit' and 'Quit' command. I mean, he pulls down the menus in Hyper Studio and is able to do it, which is quite fantastic for a Kindergarten student. I'm sure he's not reading it, but he sure knows where all the commands are. Other students are working on a drawing. One has got a Kid Pix drawing up and they are drawing on it. Another one is working on, I believe, a Reader Rabbit game.

Right now, Martha is working with one group of students. She's got four students working at a table with her. They are working one on one. They are working on

letter skills. Her students are tracing over animals and writing the letter of the animal that goes there. She has also got an aide who is working at another table with a group of four. They are actually writing sentences, which are similar to the ones that they read from the charts earlier, which has a student's name. "Jose likes Jaguars."

The students clean up their centers as they finish and they move onto another center. It's not something that the teacher directs. When they are finished with one center, it is apparent that the rule is that they pick it up and they move onto another one.

Students who have been playing with the clay pick it up very carefully and put everything back in the box. Then they move over to the Science Center, where one student picks up a stethoscope. There is a human body -- one of those body guys where you can take the parts out of the body. There are also jars full of body parts. Like there is a pig hoof in formaldehyde or something. They are right there so they can look at them. She's got a daily schedule by the door.

Every center in this room is labeled with a purpose. In other words, the Art Center or the Make & Do Center has it labeled as "The purpose is to provide children with the opportunity to experiment with paint, crayons, clay, and scissors." And every center in this room is labeled that way.

The Word Wall is in English and Spanish. Everything in this room is truly bilingual. She's got pictures in English and in Spanish. The Reading Center and the Writing Center, she has big books and a big library over in the Reading Center. The Writing Center has spiral journals, which I'm assuming that the students use for journal writing. But then there are also all kinds of paper. There is drawing paper and there are folded papers for booklets.

About this time I hear Martha laugh and say, "That is a masterpiece" to the little girl that is working with her in her group.

There are the large dollhouses where several boys are playing. They've got little figures that they are playing [with] here in these dollhouses and the barn. Two students are playing with magnetic shapes. They are the same two that went to the clay, the doctor, and now they're over here in these puzzles. One child takes a toy over to the Discovery Center and he works on trying to draw that figure by tracing over it. So they are allowed to play in any of the centers that they want to for as long as they want to. The only thing is that they are supposed to be picking up their center before they start another one.

In Martha's group, they are tracing shapes of animals. She has all these cut out shapes. They are writing the names on each page. So there are different animals on different pages. The aide's group has a large sheet of paper. I'm watching the kids over at the computer center. The launchers are on the screen, and they are able to open different programs and play these games without any direction from the teacher. The games that they are playing at this point are: one is a number game, one is a rabbit pushing carrots, and one is a car going through an intersection. I can't see what the games are. That's all I can see from where I am. So they have free choice in centers and free choice with whom they would like to play.

This room is just fabulous. One part of the room that is very interesting to me is that she has got a display of children's pictures. It looks like students that she has had before that have graduated from her class are set up in frames. She's also got little teacher knickknacks. One is an apple that says, "The world needs more teachers like you." And there is a book posted that says, "Teachers are special." So it looks like just a collection of her previous students. She had mentioned to me before that she tracks here students and keeps up with them to see how they are doing. I can tell that she is tracking them. Here's her pictures to prove it.

This has been a very interesting experience. The children are working beautifully in their groups. She's got a very large class. She's got 24-25 kindergartners.

Appendix E: Serendipity Journal Sample

9/07/00 Stephan Lynch saw me in the hall today and told me I just had to see what his students were working on. They are getting ready for back to school night, and the students are answering five questions about themselves and what is special about them. Then, the students are word processing these questions in a template he has set up in ClarisWorks. He has taken pictures of the students with a digital camera and is inserting the pictures into what the students have typed. Then, he prints it all out, and has attached construction paper backgrounds and laminated it all. Makes an interesting hall display…colorful and catchy!

10/04/00 Met with Ben Ilde today for HyperStudio instruction. Ben told me that he had very little experience with HyperStudio as, for some reason that he couldn't remember now, he had missed the training, and as it wasn't part of the competency, he really did want to learn how to work with the program. He has experience with KidPix and ClarisWorks draw/paint, so it appears that he will have no trouble at all with HyperStudio. The non-linear aspect of HyperStudio may throw him a bit, as that part is very different from KidPix.

Appendix F: Reflexive Entry Samples of Participants

WRITTEN SAMPLE

9/21/00 Reflection from Stephan Lynch

Best Ways to Learn:

1) Hands-on experiences with everyone involved in the activity
2) Group projects where everyone learns from one another and has specific roles (defined by either me or the group)
3) I like to use topics that interest them—to teach some skills. If we are talking about a math concept and I can use either their experiences or a cartoon character or a place they like in the teaching, that helps keep their interest—they remember the concept better.
4) Make it a sense of pride—tell them how they will prove people wrong about kids today or like with TAAS, we are striving to be the first school East of I35 to be recognized. We had the discussion in class about that and the kids were really pumped.

E-MAIL SAMPLE

*Date: 10/03/00
Dear Candace….

Had visitor from up above. I mean Pittsburgh. These are the Education gurus. The one's who we are supposed to model. Or should I say we are modeled after and this is why people are constantly coming to see us. We have managed to do in a couple of months what takes at least a couple of years to implement.

My thoughts on technology and teaching. I am grateful for technology. Technology is a great tool for both the teacher and the student. I use technology in my class as a multi purpose instrument. The following are examples of how computers are used in my class.

1) Computers are used as a tutor for certain subjects and geared at individual students either low or GT.
2) Computers are used as a fun learning tool for all students. (I have spent much of my salary buying appropriate materials for their use.)
3) They are used as an information source through the use of the internet or other programs likes dictionary or story disks.

4) I use it as a word processor to develop specific assignments for children.
5) I use it as a record keeper for class list/bus list/check lists.
   a) Letters to parents/office/school note etc.
   b) E-mail to own school as well as others in the district
   c) Templates that hold charts and order forms
   d) Student records
   e) Graphics/sign making etc./posters-banners
   f) Lesson Plans
6) Children have access to a variety of slide shows.
7) Kids can view HyperStudio stacks to reinforce items taught.
8) Math/Phonics/Reading games
9) Kid Pix allows kids to discover graphics and setting them up.
10) Kids learn how to type on keyboard and use mouse.
11) For advanced work for GT students - research or thinking games.
12) Just plain fun stuff.

These are a few examples of how I use technology in the classroom. While I am working at a table the computer is either being used as a center tool by children or it is printing information for me. So it appears like the computer is on constantly. I am a multi task oriented teacher. I love computers so I make sure I use them often and motivate others to enjoy them as well. I like the children to explore with them. Children teach children on the computers and this is a fun cooperative way to learn. Technology is a big part of our lives so the more we know about it and how to use it the better off we will be. I strongly feel that technology is a tool that we must all learn to use effectively. Integration of technology is essential in today's classrooms.

Here are my thoughts. I took20 minutes to put this together. It may not be worded properly. Sorry I was interrupted several times and did not have time to spell check.
–Martha

AUDIOTAPED SAMPLE

10/12/00 Debbie Haley Reflections

We're starting to make the transition in our computer usage from programs like Living Books, where they just click on pictures and there's no expected outcome, it's just a free exploration, to a Jump Start Pre-K, Jump Start Kinder, where they have to actually come up with the correct answer and earn points. It seems to be really hard for them to be able to do that. They can't figure out the directions. The software is not self-correcting. It doesn't really tell them why their choice was wrong, so it's really hard for them to figure it out. That's probably one of the

hardest things with Pre-K is coming up with a software that the kids can figure out their mistakes. That it actually shows them.

We have a really good one called Letter World which allows the kids to make choices, and if it's wrong, it says in a very loud voice, "Uh-oh" or "Oh no" or something like that. And they know immediately that that's the wrong one, and then it's got very obvious feedback when they get the right one. It lets them keep clicking and keep trying until they find the correct one, while saying, "No, uh-oh," or something like that when they pick the wrong one.

The Jump Start Preschool which is a much lower age level requirement on the software is very hard. It goes through one cycle before it goes onto the next level, so they, for the most part, are guessing on the easiest level, and if they are successful, it moves onto the next when they really can't figure it out. It's not self-adjusting or it [doesn't] have a setup so we can keep it at the right level ... I mean, at an easier level. It automatically goes forward every time they are successful to the next one, but it's not ... doesn't stay at the level long enough for them to be successful and really figure out what they are doing and get more practice.

I tried teaching several students how to use the program today and then let them go on and teach the next group how to do it. Ha! It doesn't work. I need to do whole group lesson, I think, and show everyone, and then I need to sit for a whole day and watch as each child comes and plays and re-explain it. Of course, how am I supposed to do that and still do small group? So it's kind of frustrating. Either they are really easy and it's not challenging to them or it's too hard and they quit because they can't figure it out. And I don't have time to go sit one-on-one and model the right way to do it. I tried to pick my two really good computer savvy kids to go over there and show them how to do it. But as I was observing it from across the room, they just went over there and did it. They didn't show them how to do it. So that kind of defeated the purpose. They did it so quickly that the slower kids couldn't figure out what they did or how they did it. So that didn't work. I guess back to the old tried and true -- do it on the TV and have them watch and talk about it as large group until they are more competent at it. Frustrating. I need something in between the software that I have at the moment.

[End of reflections.]

Appendix G: Reflexive Journal Sample of Researcher

Decisions and Actions	Thoughts and Feelings
September 5, 2000	
How will I address learning objectives in Stage 2?	Middle section of study should focus training on activities teachers use in classroom and then supporting these activities with technology….Activities come from structures identified before. Must think about how to address objectives in Stage 2.
September 7, 2000	
Need to keep a "serendipitous" journal to record moments that happen—outside of this journal, so can add to Nudist easier.	Stephan Lynch came up and showed me what his kids were using technology for today…preparation for back to school night…need to document this incident, and I can see this happening a lot because I am out at the school so much. Teachers have been visiting with me while I walk with them and their students to special classes, and there's no way to document these conversations. Too many important things happening that can't be documented.
September 10, 2000	
Do I need to use Continuum of Teaching Philosophy or Teaching Style Inventory as proposed in Chapter 3? They're already telling me how their beliefs look in their teaching practices and design structures.??	Going smoother than I thought! Almost all participants are not only discussing their role as teacher, but how that comes out in the structures of their classroom instruction, so I will be able to follow up on that easily through follow-up questions in their interviews.

(table continues)

Decisions and Actions	Thoughts and Feelings
September 15,2000	
Prepared continuum of teaching philosophies for teachers to use….one more way to look at the way they see	I think the continuum might provides one more way for these teachers to look at the way they think about teaching and learning I think this is necessary because a few of the teachers are still not reflecting upon "why" they do certain things as part of their philosophies in the areas of content…probably because content seems to be already decided through the TEKS and the grade level planning that has already taken place. Almost all have zeroed in on their role and how that comes out in the structures of their classes…which I was afraid I was going to have to prompt. YAY! So far, so good. But, I would like for them to think a little bit about how they really feel about "process" vs. content before we start designing professional development. I just need to know where they stand on these issues.
September 20, 2000	
Be sure to keep brainstorming sessions on straight and narrow with objectives of lesson and how technology can fit in. Will help teachers design activities that incorporate technology that fit into activities they deem valuable.	Email from Nancy Allen today! Good points to remember….objectives are the key to designing the activities.

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Appendix H: Peer Debriefing Group Minutes Sample

Peer Debriefing Meeting
September 7, 2000

Time: 11:30-1:00
Members Present: Melanie, Cindy, Candace, Joanne

Joanne
She met with Dr. Resta and will write up her participant observation as a member of the design team for publication this semester. She has a poster-discussion session accepted on this for the NAWEB 2K Conference in Fredrickton, NB-Canada in October. Joanne shared an outline for the paper with the group and said that she would be sending them a draft soon. She is not working with the course directly this fall so that should solve some of the interpersonal conflicts. She is evaluating the CSCL course of Dr. Resta's for her third directed research course this fall with him and is taking Advanced Qualitative Inquiry with Dr. Brooks this semester and excited to be getting some practical research experience.

Melanie
Susan asked her to do a 1,500 word book review for publication in the Journal of Curriculum Studies. The subject matter of the book has to do with reading in math classrooms. The group unanimously agreed that she couldn't not do this! Melanie is also teaching an Elementary Math Methods class this fall! Melanie needs to turn in her one page Dissertation Topic Statement to Dr. Cain. She plans to meet with Susan next week and set up a timeline for her dissertation research. AISD has been contacted
Her Dissertation Committee So Far:
David Molina
Patrick
Tony Petrosino
Angie
Susan
Melanie finish up the AISD paperwork to get permission for doing her study. Hopefully, this process will lead to doing the UT human subjects paperwork.

Cindy
Dissertation Defense Date Is Set: October 31' 9 AM. Cindy has been spending a lot of time working on the data., thinking about the data, explaining the data, eating the data--Good practice for her defense. The issues related to her levels of use survey have been resolved. Dr. Cain replied in a timely fashion that she

should use multiple sources but not merge the levels. Cindy was relieved when Dr. Epson said to go with what Dr. Cain suggested. However, Cindy still has many other "number crunching" dilemmas another "emerged" was that after Cindy learned the SAS match-merge command she found that she couldn't crunch the student level data so she went to campus level data and the problem of inclusion of special ed in some years and not with others surfaced. Cindy exclaimed, "You don't know what to expect, but you WILL have problems." She has plenty of student level data n=130,000. However some campuses are junior high/elementary campuses. Cindy has yet another appointment Friday. Here is her update on that:

> Hey all,
> I have resolved a few more problems (saving the file, yeah! and coding the "cmp levels of use" categorical data), but still don't have the analysis design down. I will work hard all weekend and maybe more will fall into place. Tor, the stats consultant, said this was the most complicated set of data he has seen in eight years of working as a consultant. It must be since it's so hard to explain. I posted a question to the AP-Stats group listserv and they referred me to Tor, what a vicious circle. Since he's the guy 'in the know', all I can do is keep asking him questions and hope he can figure this out. I really wish I'd selected something simpler! I told Maggie that perhaps we can answer the questions with some less complicated analysis, but she didn't exactly agree. oh well.

Candace

Candace is out in the school collecting data like crazy. She is keeping her transcriber busy. Melanie asked if Judi knew she was using a transcriber and Candace said yes, and explained why she could not do it her self as she is out in the schools interviewing, the teachers are recording their reflections, etc., because of the she quantity of the data it would be impossible for her to transcribe the information in a timely fashion. She has been busy with the first group of interviews, she has eight participants and she is presently establishing what the teacher beliefs are. She may need more than two interviews with some to clarify and extend their views. The second phase of interviewing will move on to the type of activities that the teachers are using. Her data collection should be completed by October 15th and she would like to defend around the 3rd or 4th of December.

Next Meeting: Tuesday, September 12, 2000, 1:00PM in Candace and Joanne's old office in the SZB, LTC Media Center area-ask for the sink, it is right across from there.

Appendix I: Coding/Theme Data Analysis Sample

Super Theme: Teachers' preferred educational uses of computer-based technologies may be related to their notions of the relative importance of students' interests and preferences vs. teachers' perceptions of student learning needs when planning for instruction.
Working Theme: Teaching and learning activities and use of computer activities may be influenced by teacher's beliefs about their role to nurture student interest.

Category: Student interest vs. student needs to use real world tools
Chunk—Student Interest (Student is in control of what is to be gained from instruction)

Coding Unit Label
Teacher Role (Teacher's job in teaching/best way to teach)
Student Role (Role of student in learning process)
Models of beliefs (Models of teaching that participants have seen that influence own choices)
Expectations (Standards expected for behavior or performance)
Creativity (Role in educational process of teaching/learning)
Designing Learning Environments
Accommodating Learning styles
Adjusting materials for individuals
Designing lessons for student interest (Specific comments about designing activities that provide for student interest)

Chunk—Real World Connections (Technology supports student interest because it is a real world tool)

Coding Unit Label
Teacher Role (Teacher's job in teaching/best way to teach)
Student Role (Role of student in learning process)
Models of beliefs (Models of teaching that participants have seen that influence own choices)
Expectations (Standards expected for behavior or performance)
Real Word Applications (Specific comments about use of technology as real world tool)

Other

Coding Unit Label
Personal history (Teacher background about development of teaching styles/beliefs)
Parent Role (Parent's job in educational process)
Culture (Comments about importance of inclusion of culture)
Leaving profession and reasons for considering leaving
Instructional Activities (General descriptions of activities used…not specific to subject area)
Principles of Learning (Philosophical approach to educational reform being modeled by the school this year)
Grade level planning How/why grade level plans together and values of such)
Teaching subject areas (Instructional activities specific to subject area)
TAAS/TEKS (Description/examples of TAAS/TEKS use/influence on lesson design)
DEAR (Uninterrupted sustained silent reading use)

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Vita

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