IMPACT OF STAFF DEVELOPMENT TRAINING ON TECHNOLOGY INTEGRATION IN SECONDARY SCHOOL TEACHERS' CLASSROOMS

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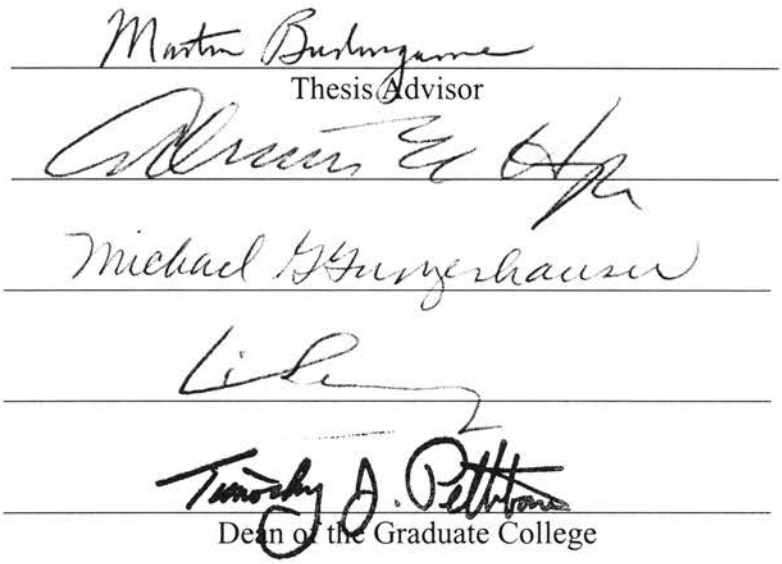

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To my family, friends, and colleagues who supported me by listening and never losing faith in me, I could not have done it without you. This endeavor over the past five years has been a process of growth. It was born out of the desire to make a contribution to the education of others as a small payment for all the patient, nurturing, and knowledgeable teachers that have touched my life. To quote John Dewey, "Education is not preparation for life, education is life itself."

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CHAPTER I

INTRODUCTION

The presidential election of 2000 afforded teachers an excellent opportunity for innovative teaching using technology. The media provided a glut of "what ifs" to encourage interest in the election. Sources on the Internet took advantage of history in the making. Social studies teachers could have seized that moment in history to engage their students. If you had been a history student in Ms. Long's classroom, you would have met in the computer lab the first school day following the inauguration of President George W. Bush. This is the kind of teaching you would have experienced.

> Ms. Long video taped President Bush's Inaugural Address. She played it on the television mounted in the corner of the computer lab. Students could follow along on the web site and read the speech or watch the tape and listen to the speech. Most students listened and followed along on the web site so they could read the speech. After watching and listening to the speech, students went to the Library of Congress site and accessed Bush's speech. They were told to choose another inaugural speech of a previous president and compare the two speeches. Students answered questions related to the goals and concerns of the country at the time of both speeches. They copied and pasted pictures and text from the Internet into a word processing document designed to look like a newspaper. Ms. Long spent the hour walking among her students. She made comments about what students found on the web site. Students moved freely around the room to look at the speeches their classmates pulled up and shared information about past presidents. (Field notes, January 2001)

How many other students transcended the boundaries of the classroom? How many were transported to Washington, D.C. to witness Bush's Inaugural Address and reflect on how closely the wants and needs of the American people in 2001 resembled those of the American people in years past? My guess would be very few.

Education is constantly under scrutiny. The processes of teaching and learning in the classroom have not changed to match the capabilities technology provides for gathering and synthesizing information. Teaching has not adapted to the changes technology makes in our everyday lives. Patrons, parents and the business community expect technology to reform education. "It seems as if there is seldom a public crisis for which schooling is not seen as at least a partial solution" (Clifford & Guthrie, 1988, p. 6).

Excellence in education is a familiar phrase in many school districts. In the twenty-first century, technology is purported to be the factor in educating students to be productive citizens. School districts take pride in the numbers of computers and other hardware available to teachers. Purchases have been made but the pedagogy tied to the use of technology remains illusive. For many teachers, redefining the role of a teacher and learning how to use technology for innovative teaching is beyond their grasp.

Throughout all the mandates for change, whether it is technology or some other issue, teachers rarely have input. They have not been given the opportunity to share in the decision-making process to modify teaching or reflect on the changing needs of students. Many of the changes in our schools have come from court cases which Sarason (1996) believes is significant.

> First, the most potent source for change has come not from within the school system, or from the state and federal policy makers, but from the courts. Second, precisely because major educational policies and legislation are rather direct derivatives of court decisions, schools have had little option about assimilating and accommodating to change. For all practical purposes, change is mandated. Third, there is the sense that there is something "wrong" in our schools that the legislation will rectify, i.e., if schools had been doing what they should, if they were not structured in such traditional ways, if school personnel thought and acted differently, there would be no need for remedial legislation. (p. 9)

Schwarz (1996a) cautions educators to look closely at what is really happening with the technology in our schools by saying, "The computer constitutes the new 'hidden

curriculum' conveying the message that technology is good in and of itself, the latest panacea" (p. 83), and "As so often happens in education, current calls to involve technology in school reform tend to ignore the realities of practice" (p. 84). Outside forces have pressured schools to make use of technology. Teachers have been inundated with innovative ideas that keep changing from year to year. To many, teaching with technology is just one more thing they are forced to do. If they are not given opportunities to learn how to integrate technology, interest in teaching with technology will quickly wane.

Educators need to be proactive when it comes to educational reform that directly affects them. Technology has motivated many teachers to change what goes on in the classroom. Students enjoy the capabilities technology provides and spend countless hours outside of school using technology. It seems that technology, which is so important outside the classroom, should be integrated into classroom practice. Using technology for innovative teaching requires a number of adjustments in both how teachers view their role as teacher and the skills necessary for teaching in a different manner. I believe it is important to look to teacher research as a means of identifying the role technology should have in the classroom and how teachers feel about using technology. How teachers perceive their role as teacher may influence the way they use technology.

Teachers are professionals. "The idea of being a professional is about conducting one's business with excellence in an ethical and faithful manner" (Rouch, 1999, p. 15). As professionals, teachers strive to keep abreast of the teaching methods designed to enhance education. Teaching needs to change as the needs of students change. Information changes so rapidly that merely learning facts is impossible. The key to learning is to synthesize and analyze the information. The classroom will not meet the needs of students if the teacher insists on being the sole source of information and knowledge. "Today, more

complex teaching activities are evolving to cope with changed classrooms circumstances. Some teachers cannot, or will not, adopt them as their own" (Esteve, 2000, p. 198).

If technology is to enhance education, teachers need training. Staff development encourages growth by building on the learning experiences teachers encounter in their lives. Using teacher lore enables educators to gain multiple perspectives on classroom practice (Schwarz & Alberts, 1998). Student achievement is not automatic once computers are installed and teachers trained (Turchi, 1996). Allowing teachers to reflect on their staff development experiences serves to enlighten educators about how teachers construct learning. Sharing teacher narratives with the public gives them insight into teaching. Cuban (1999) validates the importance of teacher voices when he says, "What corporate cheerleaders, policymakers, and vendors who have far more access to the media ignore are teachers' voices, the enduring workplace conditions within which teachers teach, inherent flaws in the technologies, and ever-changing advice of their own experts" (p. 47). If education reform is to occur, we need to look closely at what is happening in the classroom and discover the mindset of teachers who are the ones impacting learning.

My Perspective

A high school media specialist for the last 14 years, I have been a part of the evolving push for technology. Fourteen years ago all administrative functions were done by hand. It may have been old fashioned, but I could count on being able to access the card catalog even if we experienced power surges, equipment breakdowns, or the inability to spell a word perfectly. Computers were being purchased for use in the classroom and teachers could have computers on their desks if they attended staff development on how to use basic word processing functions.

I remember the anticipation of having a computer on my desk. Staff development took the form of one-hour sessions to learn how to use the equipment. Instruction was geared to those in the middle of the technology literate spectrum. A few teachers were afraid to turn the hardware on, some raced ahead of the others to forge new paths. A small but powerful few would disturb the rest of us by not being on task. Frustration ensued. At this point, I wondered if having a computer was worth the trouble.

For years this seemed to be my experience with staff development related to technology. Staff development consisted of after school sessions or workshops during professional days for the purpose of mastering a task. Instruction was not personal but geared to the class as a whole. Gradually, sessions progressed from teaching a task to creating presentations. I could put together a presentation during the staff development session but it was not a presentation I could use. If I was successful in learning the program and the hardware and software suffered no glitches, it was too long between learning the skill and using it for me to remember what to do. Time was also a factor. When I could use a presentation, I did not have time to create it.

My school district, along with other school districts and institutions of higher learning in the area, became part of a consortium making up the Professional Learning Center. The Professional Learning Center is designed to acquaint teachers with the possibilities for extending learning through the use of technology. The teacher technology training encompasses four days of instruction and hands on activities. The instructors are teachers from the member institutions who have completed teacher training. Teachers who wish to attend the training complete an application that addresses why they want to attend and establishes their proficiency in basic computer tasks. I was thrilled to be accepted to the teacher technology training.

At the Professional Learning Center I met other teachers desiring to enhance their technology skills for classroom use. Four trainers took turns demonstrating software, various capabilities of technology, and strategies to compile lessons for classroom instruction. Informally we exchanged ideas for activities and shared thoughts on software and hardware. Formally we learned how to use technology effectively and how to evaluate Internet sites. We also reflected on topics influenced by technology such as copyright, ethics, and plagiarism. The teachers serving as trainers were mentors as participants took what we learned and turned the information into presentations we could use. They acquainted me with listservs I could join and gave me email addresses of the trainers and participants. This assured me of peer support once I went back to my school. By completing the teacher technology course, I knew I could enroll in additional training conducted at the Professional Learning Center.

As a school library media specialist, technology pervades all aspects of my professional life. Not only is it a tool for administrative functions such as word processing, keeping track of budgets, or compiling consideration lists; technology changes the way people research. Technology has given us online resources, scanners, digital cameras, presentation programs, and access to countless Internet sites worthy of incorporating into lessons teachers could use. Hours of staff development time and money have been spent teaching teachers in my school new skills and resources. Unfortunately, I rarely see teachers teaching differently because of their new knowledge and their exposure to technology resources.

Traditional staff development experiences used to teach technology integration controlled what was taught, the method in which it was taught, and allowed little leeway for teachers to personalize what they learned. Once the training was over, teachers went

back to the classroom, isolated, and had little incentive to change their teaching. Traditional staff development did not typically guild on teachers' experiences. Teachers did not find staff development relevant to what they believed they need to know.

Improved staff development for technology integration lends itself to the constructivist approach to learning where "learners control their learning" (Brooks & Brooks, 1999, p. 21). I agree with the constructivist approach discussed by Brooks and Brooks that indicates learning is shaped by life experiences, more cognitive energy is exerted when teachers want to know what is being taught, and the desire to learn increases when teachers believe learning is relevant to what they want to know. Traditional staff development did not typically build on teachers' experiences or produce products to use in the classroom. Teachers did not find staff development relevant to what they believed they needed to know. Crystal (2001) suggests staff development to integrate technology should supply hands-on opportunities to create open-ended, performance-based lessons which result in collaboration between students and teachers, produces unique products, and allows for the mastery of technology skills for real learning.

My participation in teacher technology training gave me enough confidence to begin exploring new paths. Having to complete two presentations, I took care in selecting my topics so I would have something I could use to instruct teachers and students when I returned to school. I was supported by other members in my group and had the expertise of four teacher trainers if I needed help. While concentrating on the task, I could leave any hardware problems to the technicians. Watching the presentations of fellow participants, I saw how technology could enhance teaching. Teachers were excited about creating projects they could use to extend what they were already doing in their classrooms.

I think teachers should have a basic understanding of technology. Teachers serve as role models for their students who will most likely have a career that uses some facet of technology. Students come to our classrooms expecting to be entertained. The traditional pattern of schooling with the teacher directing from the head of the class and students absorbing facts will not work for most students.

The Professional Learning Center's teacher technology training introduced me to various listserves. After subscribing to the Edtech listserv, I received approximately 40 email messages daily relating to technology. Not all of them pertained to what I was doing but they expanded my knowledge of technology. I became familiar with applications, networking, software, and specific problems encountered by other professionals. I could trouble shoot problems in my library as well as share technology tips with other teachers. When I contributed to the listserve by offering suggestions to problems I encountered, it increased my feelings of worth as a professional educator.

Using technology to communicate with other professionals has encouraged my professional growth and understanding. Jamie McKenzie discusses technology in education in his online journal, From Now On. I have tremendous admiration for the contributions made by McKenzie to the education profession. The survey he designed, *The Technology in my Life* (Appendix A), asked teachers questions concerning proficiency and the importance of technology issues. When I emailed him for permission to use his survey, I was pleased to receive a quick response and an offer of support in my endeavors (Appendix B). At times I have emailed authors about a particular article I have read in a professional journal, asking for clarification or affirming their position on an issue. Responses from the authors have given me a tremendous feeling of collegiality and a desire to strive for excellence in education.

Conceptual Framework

The conceptual framework of the study guides the literature review and influences the research questions (Mertens, 1998). This study will examine the design of staff development as suggested by Glickman, Gordon, and Ross-Gordon (1995), and its relationship to technology integration. Glickman and others define staff development as all experiences supported by the school system that enhance the knowledge, appreciation, skills, and understanding of a teacher's work. One of the frequent criticisms of staff development is that the activity is "one shot" rather than sustained and is not tied to what the teacher does in the classroom (Dias, 1999; Kalmbacher & Maxson, 2000; King & Newman, 2000; McKenzie, 1999a).

Glickman and others (1995) believe effective staff development programs have the following characteristics: teachers placed in an active role, demonstrations, extended time to assimilate learning, opportunity to develop materials, peer observations, collaboration, follow up support or mentors, opportunities for feedback, and the ability of the teacher to choose activities. This study will focus on the beliefs and practices of teachers who completed technology staff development for integrating technology at the Professional Learning Center.

The teacher technology training at the Professional Learning Center exhibits many of the characteristics suggested by Glickman, et al. (1995). The training encompasses staff development that encourages adapting technology to the teacher's curriculum. Teachers are there because they have expressed a desire to further their technology training for innovative teaching. Teachers develop projects after watching teacher trainers demonstrate software and Internet sites to enhance teaching. Teachers decide how to integrate their current curriculum into new technology skills they learn. Ample time is given to teachers

for hands-on learning, enabling them to develop projects to use in their classrooms. The session lasts four days, allowing time to reflect and focus on skills. After completion of the teacher technology training, other workshops are offered if participants desire additional training. There is a support system of email addresses from other participants in the class including their teacher trainers. At the teacher's school there are other teachers who have completed teacher technology training. The extensive support system encourages continual learning and fosters teachers as leaders.

Integrating technology requires a change in how teachers conduct classroom practice. Rogers' (1995) Theory of Diffusion of Innovations will be used to discover the processes teachers go through as they learn an innovation such as technology integration. It may shed insight into whether or not teachers who adopt the innovation become leaders in technology among their peers as suggested by Sherry in her model for technology integration.

Technology use in schools

When technology entered the school setting, it was an entity all its own. It was taught as an end rather than a means to an end. Computers found their way to teachers' desks but the role technology should play in teaching and learning was not a part of the planning process. Government agencies, businesses, and the community equated the number of computers per pupil with quality education. Cuban (1999) states "Experts hired by corporate vendors and entrepreneurial academics have exhorted teachers to use technologies in their classrooms but have not addressed how computers should be used" (p. 68). In my experience teachers were seldom included in the planning process when technology was discussed even though they were greatly affected by the outcome. Teachers were not given the opportunity to establish ownership. They experienced

technology as a force driving them rather than a tool to improve their teaching (Apple, 1992; Postman, 1995).

Schwarz (1997) suggests we challenge three themes in education relating to technology: "the assumption that information equals learning, the assumption that correct procedure and control are central, and the assumption that education and job training are, or ought to be, the same thing" (p. 34). Preparing teachers to use technology must extend beyond the technological aspects and include critical thinking about how technology impacts lives and learning. What do teachers see as their role in preparing students for life long learning? How can teachers give students the educational opportunities they need to be productive citizens?

I have listened to colleagues groan when administrators presented goals tied to the use of technology in the classroom. Few teachers understood why technology should be used or how it could enhance teaching. Technology should serve as a tool to incorporate creative opportunities that extend learning (Dias, 1999; Egol, 1999; Etmer, Addison, Lane, Ross, & Woods, 1999; Gardner & McClune, 1999; Gilbert & Goeghedgan, 1995; Mellon, 1999; Morton, 1996; Roblyer & Edwards, 2000; Snider & Gershner, 1999). Literature indicates technology will not make a difference in schools until it is embraced by the teachers and integrated into the curriculum (McKenzie, 1999a).

Staff development

Fullan (1994) states that over the past decade teacher development has been one of the strategies proposed for education reform. Unfortunately, few believe it can make a difference. I believe part of the reason stems from the fact that staff development activities have not been designed to encourage the use of technology in teaching. Staff development for technology at the school level often focused on how to use technology for

administrative tasks such as communicating throughout the district by email or recording attendance and grades. Teachers were forced to attend these sessions. The tasks appeared to be for the convenience of administrators. Learning the new system and carrying out the task took time away from actual teaching.

Many teachers do not avail themselves of additional technology training to actually integrate technology into teaching. Dewey's notion of learning suggests that teachers have a say in what is being decided for them. He equated the education process with growing. Staff development that fosters growth is based on continuity; experiences build on each other, modifying what teachers know (Dewey, 1997). It is important for teachers to build on their experiences with technology so they can move from being proficient in tasks to being creative in teaching.

How teachers are educated will make a difference in shaping the new education environment that is emerging (Sheingold, Martin, & Endreweit, 1987). Effective use of technology begins with effective staff development that demonstrates best practice, provides hands-on activities that are practical, fosters support, and allows for time to experiment (Glickman et al., 1995). The kinds of experiences teachers have while learning technology integration are central to changing their perceptions of teaching and using technology to enhance classroom practice (Dusick, 1998). Teachers exposed to effective staff development should be more likely to integrate technology in their teaching.

Technology integration model

Sherry, Billig, Tavalin, and Gibson (2000) evaluated several technology initiatives which resulted in their *Integrated Technology Adoption and Diffusion Model.* They have extended Hall and Hord's *Concerns-Based Adoption Model* and Rogers' *Diffusion of Innovations* framework to define four stages teachers pass through as they develop

technology proficiency using the Internet and World Wide Web: (1) Teacher as Learner, (2) Teacher as Adopter, (3) Teacher as Co-Learner, and (4) Teacher as Reaffirmer or Rejector. As teachers get progressively more proficient with technology, they advance from one stage to another. In the stages of learner and adopter, teachers become adept at personal and task management skills. The stage of co-learner has the teacher concentrating on the curriculum rather than the task. At the stage Teacher as Reaffirmer or Rejector, teachers decide whether their experiences with technology are enhancing their teaching. If they do not believe technology is enhancing their teaching skills, they will reject using it.

Sherry and others (2000) suggest the same strategies for staff development to move teachers to the advanced stages in technology adoption as those used in the teacher technology training at the Professional Learning Center; adequate time for training, demonstrations, strategies to enhance instruction and integrate technology into the curriculum, professional development by peers, and the use of mentors. Sherry and her colleagues believe that instructional technology continues to evolve once it is reaffirmed. At that point, their model moves on to a fifth stage, Teacher as Leader. In this stage "experienced teachers expand their roles to become active researchers who carefully observe their practice, collect data, share the improvements in practice with peers, and teach new members" (Sherry, et al., 2000, p. 45). Effective staff development may assist with this process of moving to the fifth stage.

Statement of the Problem

Despite efforts to engage faculty in integrating technology in the classroom, traditional staff development has not made an impact on the use of technology for innovative teaching. The problem is: Will secondary teachers who experience effective

staff development integrate technology into their classrooms and move to the next stage of Teacher as Leader? My research questions are: (1) If secondary teachers experience the teacher technology training staff development at the Professional Learning Center, will they integrate technology in their teaching? and (2) If secondary teachers experience the teacher technology training staff development, will they move to the stage of Teacher as Leader?

Significance of the Problem

Needed Research

Most of the research on the use of technology in schools pertains to how many computers there are and their accessibility to students and teachers. Little is available on how teachers use technology to assist them with their classroom teaching. Many researchers suggest that students are motivated to learn and achievement may improve when technology is used effectively. Research conducted by Postman, Schwarz, and Cuban caution against putting too much emphasis on technology at face value. Lewis (1999) reminds us of the importance of focusing on integration by saying, "Needed are good case studies that focus upon attempts at integration. Much can be learned from such studies that can be of benefit in improving the chances of integration projects achieving their goals" (p. 7).

Research is needed to explore how technology is being used and what steps may be taken to integrate technology as a tool for teaching and learning. This study will be of interest to educators concerned with staff development issues such as administrators or technology teachers, and educators at the Professional Learning Center.

Needed Practice

Glickman and others (1995) emphasize the importance of understanding how teachers improve to assure that tasks are designed to assist teachers in their professional development as well as meet the goals of teachers and the organization. Research conducted by teachers is an important avenue to bridge the gap between theory and practice. Knowing how teachers use technology to extend classroom learning may be helpful in suggesting types of software and hardware to assist with technology integration. Administrators planning staff development for their teachers involving the use of technology may benefit from comments discussing teachers' experiences with using technology.

Trainers at the Professional Learning Center may benefit from comments teachers made about their use of technology once teacher technology training was completed. It is the intent of Sandy Lynn, one of the teachers on staff at the Professional Learning Center, that teachers be familiar with technology as a tool in order to improve teaching and learning. After interviewing twelve teachers who have completed teacher technology training, finding out which programs the teachers use may assist with designing subsequent training activities.

Although the sample is small in scope, responses to interview questions give voice to teachers who teach in districts with technology integration as a goal. The research may offer suggestions for providing staff development experiences that encourage teachers to integrate technology into their teaching. I hope the emergence of teacher narratives as they relate to practice will encourage teachers to see themselves as knowledgeable. As teachers reflect on the practice of others, they may broaden their own perspectives on technology integration.

Remaining Chapters

Chapter II includes a review of the literature pertinent to technology in schools and the progress technology has made over the last three decades. Literature on views of learning discusses approaches to learning with technology as well as effective learning environments that encourage the use of technology. The section on the dynamics of staff development examines the evolution of staff development for technology integration. The concept of teachers as technology leaders is reviewed and adapted to Sherry's *Integrated Technology Adoption and Diffusion* model.

Chapter III presents the methodology of the study which used narrative inquiry suggested by Clandinin and Connelly (2000) to determine experiences that shape learning. Experiences in technology and staff development are captured from 12 secondary teacher participants who completed teacher technology training at the Professional Learning Center. Teacher technology training follows the staff development design suggested by Glickman and others (1995) in which adult learning is fostered through experiences that are self-directed, based on previous experience, respond to solving real life problems, can be immediately applied, and encourage collaboration as well as reflection. Interviews reflect on the following: (1) how teachers improve, (2) staff development and other experiences that encourage growth, and (3) how teachers use technology in the classroom (Appendix C). The survey *The Technology in My Life* by Jamie McKenzie (1999b) helps chart the teachers' notion of how competent they felt using technology and the importance they placed on activities incorporating technology.

Chapter IV is the presentation and analysis of data. Audio taped interviews are transcribed for responses pertaining to teacher improvement, staff development, and technology. Similar comments are grouped into themes. I looked for dominant modes of

data analysis as indicated by Creswell (1994), searching for patterns which aligned themselves with literature on staff development, looking for links that explained technology integration, and tracing changes that affected teachers over time.

Chapter V concludes with the summary, conclusions, and recommendations for future research. Narrative inquiry broadens our knowledge of classroom practice. While teacher narratives serve to answer questions and solve problems, they also pose new problems to consider (Clandinin & Connelly, 2000; Schwarz & Alberts, 1998).

CHAPTER II

REVIEW OF THE LITERATURE

This chapter contains a review of the literature on: (1) technology in schools, (2) views on learning, (3) dynamics of staff development, and (4) teachers as leaders in technology integration. A review of literature gives the researcher a perspective from which to view data. Accumulated knowledge from both a review of the literature and reflection on experience helps the researcher understand data (Strauss & Corbin, 1998).

The literature review pertaining to technology in schools examines technology as it has evolved over the past forty years. It begins with a look at the historical perspective on technology, shares various views on technology, and concludes with a look at current perspectives on technology and its impact on teaching. The review of literature on views of learning related to technology discusses approaches to learning and effective learning environments. Literature on the dynamics of staff development compares the traditional design of staff development with the design advocated to encourage innovative teaching practices using technology. Literature on teachers as leaders suggests that the teaching profession needs strong leaders acting as catalysts to introduce technology and act as mentors to other teachers. The *Integrated Technology Adoption and Diffusion* model by Sherry (1997) is introduced to reaffirm the role of Teacher as Leader. Teachers as leaders in technology may make great strides toward the goal of integrating technology.

Technology in Schools

Over the past decade, technology has increased its appearance in the classroom at a tremendous rate. Technology is proclaimed to be a major factor in education reform (Wenglinsky, 2000). When one considers the vast amount of money invested in technology for schools, we have seen little return on the investment. The ratio of computers to students has improved but little has happened to improve teaching and learning. Although substantial gains have been made to place technology in the schools, teachers are not using it effectively (Burnett, G. 1994; Darling-Hammond, 1996; Dias, 1999; Levin & Darden, 1999; Mackenzie, 1999a; Morton, 1996; Padgett & Conceicao-Runlee, 2000; Picciano, 1998; Roblyer, M. D. & Edwards, J. 2000).

Many still rate schools based on the quantity of technology instead of the quality of teaching as a result of using technology. In the April 10, 2001 issue of the Tulsa World, front-page headlines read, "State schools grade well on tech report." The State Department of Education based its rating on the fact that Oklahoma schools had an average ratio of 6.15 students per computer and 81% of Oklahoma classrooms had connections to the Internet (Cooper, 2001). Rather than sit back and rest on their laurels, educators should feel intense pressure to make sure those connections result in improved teaching.

Smith (1989) believes "the arrival of the computer in the classroom seems to have preceded analysis of its probable educational role" (p. 171). There continues to be a lack of consensus about the role technology should have in education. Changes in pedagogy to make the best use of all the new teaching tools are not keeping pace with all the purchases being made (Tomei, 1997). Technology enhances learning for students when teachers are prepared to integrate it into classroom practice.

Historical perspective on technology

Computers began making their impact on society in the 1960's. Eraut (1989) gives a synopsis of the early developments of technology in schools:

> Entrants to educational technology during the 1960s usually came by one of two routes—audiovisual education or programmed learning. Each was associated with a number of possible conceptual frameworks, which practitioners adopted according to the nature of their job, their training, and their personal preference. However, whilst programmed learning could be viewed as theory driven in its initial stages, audiovisual education found it difficult to formulate any theoretical basis for its practice. In contrast, audiovisual educators could easily link their expertise to the accumulated professional experience of classroom teachers while programmed learning specialists tended to criticize teachers with a detachment that did little to promote mutual understanding. (p. 11)

Pea (1997) gives a definition of the term 'educational technologies' as it has progressed from its inception to the age of computers:

> The term educational technologies has changed over the years. In the broadest sense it refers to any resource used for activities in education. After World War II it referred to filmstrips, slide projectors, language learning labs with audio tapes and television. The 80's used the term to refer to computer based learning such as interactive videodiscs, CD-ROMS, and networking. Educational technologies have commonly been used to refer to the most advanced technologies available for teaching and learning in a particular era. (p. 274)

Finn, president of the Division of Audiovisual Instruction, first linked technology with education but it was set in the context of its role in society (Eraut, 1989). When computers were first introduced into the schools, courses at the secondary level were related to the business department. Robyler and Edwards (2000) present the three most prevalent thoughts on how computers should be used in education prior to 1980: (1) as a tool for word processing and calculating numbers, (2) as teaching aids or tutors for drills, and (3) as a tool for programming. If computers were not being used for programming, they were used for computer-assisted tasks (Salomon, 1989).

Becker (2000) indicates that functionality, capabilities, and instructional possibilities with technology have vastly improved over the last fifteen years. As costs

went down, the number of computers in the schools went up. The goal for many school districts was to put a computer on every teacher's desk. Computers tended to be used for word processing which did little more than turn an expensive investment into glorified typewriters (Bollentin, 1998).

Views on technology

Teachers have been at odds since the beginning with those who have 'stuck' computers on teachers' desks without a plan as to how they should be used. Becker (2000) relates Cuban's earlier notion that computers as a means of instruction and a tool for student learning is incompatible with teaching.

> Cuban points out that teachers have so many students to teach (or, in the elementary grades, so many different subjects to cover) that, along with the increasing accountability demanded of them, it is simply too hard for most teachers to incorporate student computer use as a regular part of the instructional practice. Moreover, computers are hard to master, hard to use, and often break down; therefore, investing effort into having students use them frequently is hardly worthwhile, and we should not expect many teachers to make this effort. Finally, all too often, district or school administrators have placed computers in teachers' rooms with the expectation that computers will become part of the teacher's instructional repertoire, even though teachers did not ask for them and did not have specific plans for using them. (Becker, p. 1)

Technology changes so rapidly that it has become somewhat elusive especially in the minds of educators. Baker (1998) sheds insight into why the thought of using technology might cause concern for some teachers. Baker says,

> All technology is on a continuum, of course, from slight modifications of the very familiar to the design of radical new systems. All technology also achieves its goals at the expense of others. To many of us, technology also conjures up an enterprise that is recent, changing, and innovative and that forces us on occasion to leave behind more familiar and sometimes more comfortable options. The 'newness' in technology is a matter of vantage point. Consider the topic of windows—glass ones, not the kind that Microsoft produces. The window was a new technology in the Middle Ages. In churches, its purpose was to give light; to create a particular, prayerful ambiance; and, more practically, to tell religious stories with the result that heretofore private knowledge became distributed. Sort of like the Internet... After the technology has been used in one form, it continues to

> evolve or becomes irrelevant. It pushes us to new knowledge and to new applications that we might not have conceived of without its invention. (p.6)

Where technology once was a neutral machine or a process, technology has evolved into a system comprised of complex processes manipulated by people with various notions of how technology and education should be structured (Muffoletto, 1994). Business and governmental agencies view technology as a great tool for research and productivity. Children and teens view technology as a cool way of being entertained. Educators are expected to use technology to reform education. Teachers find technology equates with extra work at a time when teachers are stretched to do all that is required of them.

Postman and McKenzie are critical of education and computers. They both suggest that society look closely at what is going on in the schools in the name of technology and education. Postman (1995) thinks it is "embarrassing" that technology needs to be proposed as an innovation in our schools:

> Americans never tire of telling themselves that they have created a technological society. They even seem to be delighted about this and many of them believe that the pathway to a fulfilling life is through continuous technological change. One would expect that technology education would be a familiar subject in American schools. But it is not. Technology may have entered the schools but not technology education. (p. 189)

McKenzie (1999a) suggests schools are frozen between tradition and chaos. Proponents of technology exaggerate about what they can do with technology. Often those who experience more failures than successes ignore them. Failure to be successful partly lies in the failure to clarify goals. Technology is not an end in itself but merely a tool to accomplish goals.

Pierson (2001) criticizes education for not planning for the implementation of technology which resulted in an "evident disparity between instances of classroom

technology use, with teachers who are attempting innovative integration ideas sprinkled throughout a selection of users and nonusers" (p. 2). Because education seemed unable to set plans for integrating technology, forces from outside of education led the implementation process.

Current perspectives on technology

In 1996, the United States Congress passed legislation setting the stage for a goal of having all schools connected to the Internet (Robinson, 1998). Connectivity offered unending possibilities for the use of technology to extend student learning. Government and various businesses are pressuring schools to catch up with society and maximize the potential for innovative teaching using technology in the classroom. Poole and Moran (1998) confirm the need for teachers to acquire the skills and the pedagogy to prepare students for tomorrow's workforce by saying,

> Across the nation many schools are bombarded with technology: new computer labs, media retrieval systems, business partnership software programs, etc. Students are exposed to so many technological devices and information resources that one would think the transition from school to workplace would be second nature. However, according to recent projections, only about 22 percent of people currently entering the labor market possess the technology skills that will be required for 60 percent of new jobs in the year 2000. (p. 60)

Technology is a part of our culture and a dominant force in what has become the Information Age. Kuhlthau (1999) believes education in a free society should prepare students for the workplace, citizenship, and daily living:

> First, in preparing students for the workplace, consideration must be given to the ways that technology changes the nature of work and raises new questions about how we contribute and innovate productivity in the global economy. Second, in preparing students for citizenship, consideration must be given to the ways that technology changes our sense of community and raises pressing questions about how we participate as an informed electorate in a democratic society. Third, in preparing students for daily living, consideration must be given to the ways that technology increases the complexity of everyday life and raises troubling questions about how we gain a sense of self in relation to others and experience creativity and

> joy in our personals lives...All three charges involve an inquiry approach to information seeking and information use; inquiry underlies information literacy. (p. 8)

Technology is a complex issue. "Technology, like education, is situated in philosophical, social, and economic constructs which work to serve larger interests and benefits" (Muffoletto, 1994, p. 24). Many factors deter teachers from embracing technology as a teaching tool. Most teachers can relate to the frustration of spending hours on the Internet and still not finding useful information. Teachers who are easily distracted end up wasting even more time searching links that seem interesting but still result in false hits. Lewin (2001) discusses the dilemmas brought about by the Internet:

> The Internet provides the immense potential of countless digitized resources to offer students on millions of subjects. These resources from around the world can be up-to-the-minute in their accuracy and collectively represent a variety of viewpoints. Best of all, they are rapidly accessible. But on the other hand, the Internet presents us with immense challenges, such as readability issues, source credibility/reliability issues, and huge issues of dealing with a mind-numbing number of links that can lead even a skilled navigator off in the Land of the Lost. (p. 7)

It is important to look at how technology is to be used, the functions it has, and how those who use technology interpret it (Pea, 1997). Without careful examination of use, function, and interpretation, we cannot maximize the innovative teaching capabilities of technology.

Politicians have had several congressional hearings to debate the role of technology in schools. One of the subcommittees of the Committee on Education and the Workforce met on March 8, 2000 to discuss how technology could improve education in our schools (Role..., 2000). The hearing focused on a survey done by Education Week to support training as a means of moving teachers toward technology integration.

> A recent survey released by Education Week shows that training plays a critical role in how teachers use educational software and web sites or digital content. Teachers who have more technology training are more likely to use digital content in their classrooms, are better prepared to use it, and rely on it more heavily than teachers

> with less training. For these reasons, we must be sure our teachers appreciate the benefits of education technology and teach them to integrate it into their lesson plans. (Role..., p. 2)

When research suggests training, it is usually tied to the need to alter some of the aspects of teaching. The changes suggested in teaching are a reaction to the changes occurring in society.

> Our democratic society is being transformed as we rapidly move toward an information society and a global economy. The changes are happening more quickly than schools seem able to accommodate. From cognitive theorists to business executives, people outside schools are pressing people inside to teach students how to frame and solve problems, to think critically, to develop a multicultural awareness, and to demonstrate mastery of basic skills. All these have strong implications for teaching. (Lieberman & Miller, 2000, p. 48)

Technology and its impact on teaching

If technology is going to make strides toward improving education, teachers need to readjust their notion of teaching. Lieberman and Miller (2000) suggest the transitions teachers need to make as they prepare to integrate technology in their classrooms.

1. Teachers need to move their focus of teaching from mastery of skills and techniques to engaging in the process of discovery and reflection.
2. Accountability should change from controlling student behavior to focusing on public responsibility for student performance.
3. The teacher's role should change from one who manages work to being a leader in curriculum, instruction, and teaching.
4. Teachers need to move from individuality to collaboration. They need to address the needs of all students in every classroom of the school.
5. Teachers need to broaden their knowledge base by drawing on a wealth of information and basic research to guide practice and professionalize their work.

The *Forum on Technology in Education: Envisioning the Future*, held in December of 1999 (Office of Educational Technology, 1999) addressed the need for schools to evaluate how technology was being used. At that conference, Thornburg cautioned educators to keep two ideas in mind: (1) how teachers use technology is more important than if it is used at all, and (2) technology investments will not live up to their potential unless we transform the way we think of education and technology is integrated in the classroom.

The section on technology in schools challenged schools to integrate the technology already placed in schools and use it for innovative teaching. It discussed the early arrival of technology in schools and the fact that schools neglected to make plans for implementing technology. Educators did not have a clear notion of the role technology should play in educating students. Technology is an excellent avenue for preparing students to be productive citizens in a global society. Technology can impact teaching and learning if teachers are willing to learn how to use it effectively and adapt it to their own style of teaching.

The next section on views on learning establishes the need for educators to consider the concept of learning in order to succeed in teaching teachers to integrate technology. Learning is affected by past learning experiences. It is vital that staff development to learn how to use technology be a design that encourages technology integration. Learning environments are also discussed in regards to students. For teachers to equip students with knowledge for life long learning, they must revisit the learning environment necessary for today's students.

Research continues to enlighten educators on learning. Learning styles vary from individual to individual. Pierson (2001) discovered that to integrate technology in the classroom, it takes more than just technology competency; one must also have an understanding of the unique characteristics of types of technologies that would lend themselves to particular aspects of the teaching and learning process. Technology has changed how we live our daily lives as well as how children and adults learn (Kuhlthau, 1999). Everyone is exposed to a greater variety of resources. Learning becomes more complicated as we sort out the information to learn.

Views on learning

Although most educators would agree technology should be a part of today's educational framework, they do not agree on the strategies to use in order to reach educational goals. Robyler and Edwards (2000) define two views on how to approach learning with technology:

> Directed instruction is grounded primarily in behaviorist learning theory and the information-processing branch of the cognitive learning theories. The other view, which we will refer to as constructivist, evolved from other branches of thinking in cognitive learning theory. A few technology applications such as drill and practice and tutorials are associated only with directed instruction; most others (problem solving, multimedia production). Web-based learning can enhance either directed instruction or constructivist learning, depending on how they are used. (p. 49)

The objectivist approach and the constructivist approach both have valid points depending on how the student learns. The objectivist believes learning is transmitted knowledge and teaching should be teacher-directed within a structured environment, while the constructivist believes all learning is constructed knowledge and teaching should allow students to participate in meaningful activities to generate their own learning (Robyler & Edwards, 2000). To complicate matters, studies in emotional intelligence caution us to

consider the reasoning going on in the head and heart as well as in the brain (Cobb & Mayer, 2000). No one approach will work for everyone.

It is important for educators to develop an awareness of what is involved in learning, both for training teachers and instructing students. Past experiences will make a difference in how learning is received. The process of learning is different for everyone. The best approach depends on the needs of the learner.

Knowledge needs to be relevant for learning to be successful. Research from the Rand Change Agent Study and the Center for Research on the Context of Secondary School Teaching, 1989 (McLaughlin 1991), indicates that just because teachers know how to do something better, it does not mean they will apply that knowledge once they are back in the classroom. Relevant knowledge helps people organize information so they remember what they learn and can make references to other situations by monitoring their progress and making necessary changes (Bransford, Brown, & Cocking, 2000). Teachers need on-going assistance, collegiality, concrete training with follow-through, and principal support if they are going to learn how to make changes in teaching.

The National Research Council conducted a two-year study on experiences with learning and teaching. Their focus was on factors that led to effective teaching conditions that fostered effective learning environments for both learning and teaching. They found that transfer of learning required the following: (1) people must have sufficient understanding of the initial learning in order to transfer the learning, (2) learning must be supported with hands-on activities which are monitored, (3) when learning occurs in multiple contexts, there is a greater flexibility for transferring knowledge to other areas, (4) learning is affected by prior knowledge and experience, and (5) prior knowledge may impede learning if there are concepts that need to be changed (Bransford, et al., 2000).

Bransford and others (2000) have discovered some interesting facts on learning that reflect the need for teachers to be exposed to a good staff development design when they participate in staff development for technology integration:

> Work in social psychology, cognitive psychology, and anthropology is making clear that all learning takes place in settings that have particular sets of cultural and social norms and expectations and that these settings influence learning and transfer in powerful ways. (p. 4)

Teachers will bring past experiences to the learning environment. What transpires during the learning will affect how the new skills will be incorporated into the old style of teaching.

Education has changed its focus. In the early part of the twentieth century it focused on the acquisition of literacy skills which included simple reading, writing, and calculating; today we expect students to read critically, express themselves clearly and solve complex problems (Bransford et al., 2000). Teachers need to teach differently if those skills are to be developed. Teachers should be motivated to learn new ways of teaching if they recognize that the needs of today's students have changed and that innovative teaching with technology can impact those changing needs.

People should be the priority when learning new skills in technology, not technology (Norman, 1999). Activities need to be geared to the teacher's individual teaching style and teachers have to believe technology is worth the hassle. Teachers need to understand their own reluctance toward learning how to use technology and take the initiative.

> Many teachers are uncomfortable and lack confidence in using computer technology. For some it is an extension of the basic 'computerphobia' that exists in the general population. In the extreme, some teachers feel threatened by technology and fear losing their jobs. Many educational leaders dismiss the idea that computers can replace teachers, but the natural evolution of technology is such that the nature of people's jobs will change. (Picciano, 1998, p. 192)

Effective learning environments

According to Kuhlthau (1999), the vast resources available as a result of technology make the traditional textbook approach to teaching and learning obsolete. New approaches to learning require effective learning environments. Bransford and others (2000) suggest five ways technology may contribute to learning environments.

1. Bringing real-world problems into classrooms through the use of videos, demonstrations, simulations, and Internet connections to concrete data and working scientists.
2. Providing "scaffolding" support to augment what learners can do and reason about on their path to understanding. Scaffolding allows learners to participate in complex cognitive performances, such as scientific visualization and model-based learning, which is more difficult or impossible without technical support.
3. Increasing opportunities for learners to receive feedback from software tutors, teachers, and peers; to engage in reflection on their own learning processes; and to receive guidance toward progressive revisions that improve their learning and reasoning.
4. Building local and global communities of teachers, administrators, students, parents, and other interested learners.
5. Expanding opportunities for teachers' learning.

Technology calls for rethinking the teaching that goes on in schools. Research indicates that staff development which addresses student learning of important skills and concepts appears to make a difference in student learning (Wenglinsky, 2000). Teachers who value effective teaching should make an attempt to model best practice. Teachers need to

move their focus of teaching from mastery of skills and techniques to engaging in the process of discovery and reflection.

The literature overviews of learning suggest that teachers examine their approaches to learning and consider how they may adapt their learning and teaching to the needs of their students. Technology changes how we learn. Teaching needs to reflect the learning required in today's society. Technology provides new methods for teaching that will enhance student learning. What prompts a teacher to become proficient in technology and integrate it into classroom practice? What types of professional development opportunities should be offered to encourage effective use of technology in teaching?

The next section on the dynamics of staff development will examine the traditional staff development design and present literature to suggest why the design did not work for technology integration. Literature will reflect the current recommendations for successful staff development for technology integration.

Dynamics of Staff Development

Staff development includes the "legally sanctioned and supported learning opportunities provided to faculty by the school and school system" (Glickman, et al., 1995, p. 8). The goal of staff development should be to assist the teacher in providing an optimum learning environment for students. Teachers are expected to participate in the latest staff development opportunities to enhance their teaching but are often forced to do it on their own time. Most teachers do not find the customary staff development offered by school districts to be relevant to their classroom practice (McLaughlin, 1991). It is important to strike a balanced, career-long approach to staff development that takes the

career stages of a teacher as well as the interests of the teacher into consideration (Janas, 2001).

Traditional design for staff development

Staff development has progressed from the 1970's notion of being relatively unimportant to a taken-for-granted component of most education reform initiatives (McLaughlin, 1991). Robb (2000) gives us an accurate view of the kinds of traditional staff development activities that teachers used to attend, some unfortunately still do:

> Staff development, the foil to professional study, is often presented as one experience in time, when an authority on a topic crams information into teachers' minds with little to no knowledge of the school's culture and varied needs. Such presentations deter inquiry because one-time staff development programs do not respond to teachers' questions, nor do they provide the follow-up necessary to create growth and change. (p. 2)

Many educators prefer to use the term professional development instead of staff development. In my mind, staff development and professional development may be used interchangeably. My expectation is that the activities are designed to enhance the teacher's professional role as teacher. The staff development activities may include new methods of instruction or skills in materials, introductions to new software and hardware, or activities to enhance students' understanding of concepts so they will be equipped to solve problems. One thing educators are realizing about staff development is that the focus must change from generic to specific (Janus, 2001). According to McLaughlin (1991), "Staff development a decade or so ago dwelt on a process-product paradigm focusing on generic teaching skills; recent research indicates content matters" (p. 64).

Robb (2000) describes the components of traditional staff development and suggests why it inhibits professional growth.

1. One-day teacher training: Sessions do not account for differing levels of expertise and teachers are overloaded with information. Teachers leave confused and frustrated, often rejecting what was presented.

2. One-size-fits-all presentation: Districts spend a great deal of money on outside speakers who lack the knowledge of the school's culture, teachers or students.

3. Minimal administrator participation: Lack of administrator participation sends the message that the activity is not important.

4. Lack of follow-up support: There is no expert available to support teachers as they risk trying out new ideas.

Cooper (1991) suggests why traditional staff development activities failed to improve teaching:

> Teachers were isolated professionally. They were cut off from those who judged them and unable to interact with those who shared their concerns. The knowledge base for good practice, which was growing in the researchers' universe, continued to be unavailable to the mainstream of practitioners. The teachers' insatiable need for variety of repertoire and versatility in technique was unmet. Time for training, reflection, and experiment was virtually nonexistent. (p. 84)

Staff development design for technology integration

The design for staff development is important if educators expect staff development to lead to technology integration. Staff development should be a model for what is expected in the classroom. Transfer of learning occurs when a teacher is able to take what was presented during staff development and apply it to another context; namely the classroom.

Effective staff development programs take complex planning. They should include the following characteristics: (1) teachers taking an active role, (2) demonstrations modeling the desired activity, (3) extended time to assimilate, (4) time for teachers to develop materials, (5) peer observations, (6) opportunities for collaboration, (7) follow-up

support, (8) the ability to offer feedback, and (9) teachers being able to choose activities (Glickman, et al., 1995; Picciano, 1998). Other concepts that work well to encourage innovative teaching are mentoring, finding ways to capitalize on teacher's creativity, incentives, and on-going staff development.

Educative mentoring embodies all education experiences that promote future growth and lead to richer experiences (Feiman-Nemser, 2001; McKenzie, 2000). Mentoring new teachers is similar to mentoring teachers who are new to the concept of technology integration. There needs to be an exchange of educational philosophies as well as a sharing of technological expertise.

Mentoring is a contradiction to the traditional learning environment where the teacher operates in an atmosphere fairly devoid of other teachers. Not all teachers are eager to collaborate with their peers. Some teachers feel constricted by the required objectives to be completed in a school year and believe collaborating is a luxury. Those who have taught for years and been considered an effective teacher, may not want to take the risk of teaching differently. They have developed a set of lessons and tests that work well. If a teacher has spent a lot of time and effort creating lectures and projects to accomplish curriculum goals, they do not always want to share them with others. It is easier to remain isolated and do what is comfortable without relying on other people to alter the routine.

Research suggests teachers need staff development opportunities that foster collaboration and skills in real-world contexts. Picciano (1998) conveys the benefits of training teachers to do the training: it is cost effective over time, develops a knowledge base, and fosters an attitude of teamwork. Sharing technical skills and creative ideas can be rewarding for teachers and schools reap the benefits.

Woods (1990) believes teachers are not creative because their jobs are constraining in nature; however, by reflecting they can constructively evaluating what they do in the classroom and improve their teaching. State Departments of Education mandate what teachers are to do in the classroom and districts have skills that students are expected to exhibit at different grade levels. There is not always a lot left to the imagination for a creative teacher. Classes, especially at the secondary level, are fairly routine. As teachers experience different situations in their classrooms, they are adopting new ways of teaching. Teacher creativity requires reflective time for ownership and control, greater range of resources, supportive school climate where the teacher is valued and encouraged, and a student culture responsive to creativity (Woods).

Staff development programs should consider providing incentives for teachers to ensure active participation. Both intrinsic and extrinsic rewards need to be considered for teachers who become substantially involved with developing staff and implementing technology in their schools. Professional growth, stimulating involvement with instructional innovations, experimentation with different teaching styles, and other intrinsic rewards may be the most important reasons that teachers become involved with technology. However, because of the time and effort involved, particularly in districts that have fallen behind technologically, more extrinsic incentives such as extra compensation, release time, or fits of equipment are also needed (Picciano, 1998).

Staff development for technology needs to be a continuous process because of the constant changes in technology. In order to educate students to be productive citizens, teachers need to be exposed to as many technological advances as staff development opportunities and funding will allow. The challenge is to provide for what educators need in the way of technology, when no one really knows what will be needed.

Drucker (1994) shares his opinion that "Education will become the center of the knowledge society, and the school its key institution" (p. 545). In many people's minds, technology is synonymous with knowledge. Education needs to be synonymous with knowledge also. Teachers must demonstrate that technology and knowledge can be associated with education in the classroom. Ideally, schools should foster learning experiences for both teachers and students that encourage on-going learning that incorporates technology.

Encouraging teachers to integrate technology calls for staff development designed to promote innovative teaching with technology. Teachers are more apt to learn if experiences fall in line with their notion of teaching. Teachers come to the classroom with various notions of the role teachers should play, how the classroom should be constructed, and what should be learned. Attitudes concerning technology are fundamental. Besides experiencing a good staff development design, teachers need to be willing to teach differently than the way teachers have traditionally taught. They must have the proper attitude and a willingness to change or staff development will not lead to innovative teaching.

The next section reviews literature on the need for teachers to act as leaders in technology integration. There are many advantages to using teachers as trainers and mentors. Teacher trainers understand the limitations of the classroom. Their experience makes them credible to other teachers. Those who reaffirm their decision to integrate technology do act as leaders and mentor other teachers as indicated by the *Integrated Technology Adoption and Diffusion* model by Sherry (1997).

Teachers as Leaders

Strong leadership is necessary for teachers to incorporate new ways of teaching. Teachers who prefer teaching in isolation and being the main focus of instruction will find it hard to move into the role of facilitator (Davies, 1998; Sarason, 1996). Leaders working with technology have to be life-long-learners. Technology changes daily. Keeping up is difficult. "The technological world is simply too vast and changing for one person to stay on top of it" (Computers... 1999, p. 1).

Teachers make good trainers and should teach teachers. By doing so, teachers without an abundance of skills learn new approaches to their teaching while those who have skills refocus and renew their enthusiasm (Cooper, 1991). Teachers "who learn from their empowered roles enhance their performance not to be doing more of the same but by taking new and different approaches" (Howard, 1996, p. 209). Learning increases the skills and knowledge of the leaders. Having teachers as leaders lends confidence and credibility to the technology skills leaders exhibit. When other teachers see leaders who are successful with technology, they are more willing to learn new skills.

Technology adoption model

Sherry (1997) modified Everett Rogers' *Diffusion of Innovations* framework to capture innovations relating to the adoption of technology. Rogers (1995) describes the five characteristics of innovations.

1. Relative advantage: The degree to which an innovation seems better than what was being done before the innovation. Economics, social prestige, convenience, and satisfaction all affect perception. The greater the perceived advantage, the faster the adoption.

2. Compatibility: The degree to which the innovation seems compatible with existing values, past experiences, and needs of the adopter.
3. Complexity: The degree to which the innovation seems difficult to understand and use. If the innovation requires new skills and understandings, adoption may take longer.
4. Trialability: The degree to which the innovation may be experimented on a limited basis. Since is it possible to learn by doing, trying out the innovation leaves less uncertainty for the adopter.
5. Observability: The degree to which the innovation may be visible by others. Seeing the innovation in action allows for peer discussion and increases understanding of the innovation.

Change is not readily accepted, especially by teachers who have conducted their teaching the same way for decades (Clifford & Guthrie, 1988; Robb, 2000; Sarason, 1996; Tyack & Cuban, 1995). *The Diffusion of Innovations* theory works well for teachers wishing to adopt an innovation such as using technology in teaching. There is an advantage to teachers using technology if teaching and learning will improve for both groups. Laying the groundwork is the responsibility of the district which includes the following; carefully outlining the vision and goals for education, providing appropriate staff development for technology integration, and supporting teachers as they acquire skills in technology.

Once the groundwork is in place, the next step is up to the teachers. Using technology effectively in teaching is more likely to occur if the following conditions exist: (1) teachers are able to perceive the innovation as advantageous, (2) it is compatible with teachers' values, (3) it is easy to understand and use, (4) teachers have the ability to try out

the new technology skills, and (5) they may observe other teachers using technology successfully.

Sherry (1997) did a research study based on Rogers' *Diffusion of Innovation* model that led to the *Integrated Technology Adoption and Diffusion Model*. Sherry based her research on the Boulder Valley Internet Project, which introduced the use of telecommunications in the classroom. The "trainer of trainers" model met with excellent success, primarily because it incorporated two of Rogers' fundamental concepts: homophily and observability" (Sherry, 1997, p. 69).

After evaluating several educational technology initiatives Sherry, Shelley, Tavalin, and Gibson (2000) added another dimension to the original model. They observed that as teachers progressed from the stages of learners to adopters, to co-learners; and then on to making a decision to reaffirm or reject using technology, a fifth stage emerged. If teachers reaffirmed the use of technology, they progressed to the fifth stage of Teacher as Leader. Sherry and her colleagues (2000) noticed that the traditional role of teacher was restructured as teachers created and shared standards and rubrics.

I believe training teachers to be leaders will make the most significant impact on innovative and improved teaching by integrating technology into classroom practice. The type of leader needed to facilitate technology integration needs to "view leadership as a verb, rather than a noun, by considering the processes, activities, and relationships in which people engage, rather than as the individual in a specific role" (Lambert, 1999, p. 18). Lambert's suggestion that shared learning needs to take place with leaders releasing authority, and enhancing personal and collective power applies to teachers who act as trainers or mentors.

If teachers are going to follow a leader and risk changing the way they teach, they have to believe their leader has credibility. Credibility depends on the following beliefs: (1) leaders know what they are doing, (2) they will do what they say, (3) they are interested in the teacher's interests and welfare, and (4) they will persist in the face of adversity (Kouzes & Posner, 1993). Risk taking is easier when teachers know there is support to sustain them through the difficulties. Credible leaders instill confidence in their followers.

Good leaders care for fellow teachers and use their knowledge to find the easiest way to accomplish tasks. Facilitators empower teachers. Empowering can be done by seeking better ways of doing things, guiding teachers, showing confidence, lending a helping hand, and smoothing the way so obstacles do not impede progress (Howard, 1996).

The section on Teachers as Leaders suggested school districts encourage the use of teachers as trainers or mentors. Teachers who are leaders in technology integration enhance their own skills as they demonstrate the use of technology. Encouraging the adoption of innovations such as technology integration is more likely to happen if teachers understand how to use technology and have the opportunity to experiment with technology while supported by leaders.

Summary

Traditional staff development has not encouraged teachers to use the technology found in schools today. Students and patrons are surrounded by technology and expect teachers to use technology in the classroom. Technology must be an integral part of our schools if schools are to stay in step with the rest of society (Pea, 1997).

It seems obvious that more training would lead to greater use of technology in the classroom, but it takes more than good training. It is important to consider how people

learn and adapt new concepts to their existing skills. Good training must include teachers being placed in an active role where demonstrations and opportunities for hands-on activities aid in understanding. Teachers need to be supported once they go back to the classroom and begin implementing new techniques for technology integration.

It takes time before new concepts in teaching will be fully adopted by teachers. Assimilating new techniques are more likely to happen if teachers who are proficient in the techniques will serve as leaders and model best practice for technology integration. Teachers who are interested in delivering the best education possible to their students will be more likely to use technology if they see how it benefits students. If schools expect to educate the workforce of tomorrow, they need to develop staff development programs that will strive for innovative teaching that leads to improved learning for all students. The task is great.

> More than ever, the sheer magnitude of human knowledge renders its coverage by education an impossibility; rather, the goal of education is better conceived as helping students develop the intellectual tools and learning strategies needed to acquire the knowledge that allows people to think productively about history, science and technology, social phenomena, mathematics, and the arts. Fundamental understanding about subjects, including how to frame and ask meaningful questions about various subject areas, contributes to individuals' more basic understanding of principles of learning that can assist them in becoming self-sustaining, lifelong learners. (Bransford, et al., 2000, p. 5)

CHAPTER III

METHODOLOGY

The purpose of this study was to explore a particular staff development design to determine if the design would encourage technology integration. I also wanted to discover if teachers who were proficient in technology and embraced technology would become technology leaders among their peers. This chapter presents the research methodology that guided this study and the rationale for the design. It addresses how participants were chosen, reasoning for use of the survey, information about the interview process, and the methods of analysis. Efforts used to ensure reliability, validity, and generalizability of the study are also included.

Rationale for the Method

Qualitative research is an important aspect of discovering best practice. How can attitudes be changed, teachers be motivated, technology shared, efforts to gain skills in technology be rewarded, and district funding increased to support teachers' efforts in innovative teaching? To quote Olson (1990), "Looking carefully at what teachers tell us about practice and about innovation is related: innovation ought to be a remedy for dysfunction, and reflecting on practice the way to diagnose it" (p. 78).

My qualitative research reflected the notion that "qualitative interviewing emphasizes the relativism of culture, the active participation of the interviewer, and the importance of giving the interviewee voice" (Rubin & Rubin, 1995, p. 31). I used an

interpretive approach as defined by Rubin and Rubin (1995) because I believe it is important to find out how people make sense of their world. I was interested in finding out how teachers enhanced their teaching abilities, the role staff development played in improving their teaching skills, and their perceptions of technology as a component of teaching. If teachers believed technology was an integral part of their teaching, I wanted to understand how they learned and what kinds of staff development they thought were effective in enhancing their teaching. I was also interested in whether or not they saw themselves as technology leaders.

Qualitative studies allow the researcher to interact with participants. The language of the qualitative study is personal, informal, and based on definitions that evolve during the study (Creswell, 1994). Marshall and Rossman (1989) suggest two criteria for judging qualitative research: (1) informational adequacy which makes certain the researcher will have a clear and accurate understanding of the setting and information desired, and (2) efficiency which allows data to be gathered as quickly and effortlessly as possible.

One of the theoretical orientations of qualitative research is symbolic interaction which Bogdan and Biklen (1998) define as "Objects, people, situations, and events do not possess their own meaning; rather, meaning is conferred on them" (p. 25). Teachers give meaning to the experiences they encounter while seeking to improve how they teach. The meaning they assign to staff development designed to integrate technology will influence how they use technology in their teaching.

Case studies allow the researcher to explore a single entity or phenomenon bounded by time and activity, and collects detailed information using a variety of data collection methods (Creswell, 1994). The use of interviews, surveys, and observations allowed the researcher to find out what teachers did in the classroom and the types of staff development

they preferred to improve their teaching. "Qualitative methods can be used to obtain the intricate details about phenomena such as feelings, thought processes, and emotions that are difficult to extract or learn about through more conventional research methods" (Strauss & Corbin, 1998, p. 11). When teachers reflected on staff development activities and how they learned to incorporate technology into classroom practice, it gave me insight into the impact staff development had on technology integration.

Narrative inquiry suggested by Clandinin and Connelly (2000) was used to help the researcher understand experiences. The researcher used it to help determine how the experiences of the teacher participants shaped learning. Glickman and others (1995) emphasize the role of experiences in learning. Adult learning is fostered through experiences which are self-directed, based on previous experience, respond to solving real life problems, can be immediately applied, and encourage collaboration and reflection (Glickman, et al.). Through interviews I encouraged teachers to reflect on the following: (1) how they learned, (2) staff development and other experiences that have encouraged growth, (3) how they used technology in their classrooms, and (4) how they shared their knowledge of technology with their peers.

Surveys allow the researcher to extract beliefs and values held by participants (Marshall & Rossman, 1989; Kvale, 1995). McKenzie, the editor of an online journal entitled From Now On, has extensive experience in the use of technology in schools. He gave me permission by email to use his survey *The Technology in My Life* (Appendix B). The survey was used to chart the teacher's notion of how competent they felt using technology and the importance they placed on experiences connected with technology.

Research Questions

My research objectives addressed classroom practice and leadership as it applied to technology integration. The major research questions were: (1) If teachers complete the teacher technology training staff development at the Professional Learning Center, will they integrate technology in their teaching? and (2) If teachers complete the teacher technology training staff development, will they move to the stage of Teacher as Leader?

Selection of Participants

Twelve secondary teachers were selected to be participants. Teachers signed a consent form prior to being interviewed (Appendix D). They were contacted by email or telephone after their respective principals gave me permission to interview them (Appendix E). I guaranteed both principals and teachers that the names of the schools and teachers who participated would remain anonymous. I chose the teachers based on their completion of the teacher technology training at the Professional Learning Center. I believed the information, demonstrations, and hands-on activities incorporated in the training encouraged technology integration. I also knew the teachers had basic computer skills based on the requirement on the application for training that says participants are to have Level One skills (Appendix F). I used the Professional Learning Center as the setting for technology training because it exemplified the design for effective staff development suggested by Glickman and others (1995). Because I have also completed the teacher technology training, I had first hand knowledge about the philosophy and training embodied by the Professional Learning Center.

The 12 secondary teachers represented the following subject areas: English, science, history, and business. Teachers were selected from four school districts: West Public

Schools, East Public Schools, Central Public Schools, and South Public Schools. The four school districts support using technology in the classroom and have similar student populations. They all participate in the Professional Learning Center Consortium. I selected six teachers from my own district that I knew used technology and had completed teacher technology training. Two teacher trainers who worked with teachers at East Public Schools, Central Public Schools, and South Public Schools recommended the participants I chose from those districts. One of the teachers from East Public Schools attended the same teacher technology training session I attended.

Data Collection

Data consisted of surveys, audio taped interviews, and observations. The survey asked teachers to indicate their competency and rate the degree of importance for several issues relating to technology and asked them how they felt about learning new technologies and programs. Interviews included seven questions concerning staff development for improved teaching and teachers' experiences with technology. Observations were used to validate the interviews.

Surveys

Each participant filled out the survey, *The Technology in My Life* (Appendix A), at the time of the interview. The survey was used to follow up on the information obtained in the interview. The purpose of the survey was to chart the teacher's notion of how competent they felt using technology and the importance they placed on experiences connected with technology. It was a way to estimate the strength of their beliefs regarding technology related issues and how integral technology was to their day-to-day teaching. I hoped it

would help me place teachers in the various stages of the technology adoption model (Sherry et. al., 2000).

Interviews

Topical interviews are used when a researcher wants to learn about particular events or experiences (Rubin & Rubin, 1995). I used a conversational interviewing technique to discuss the impact of professional development in learning to integrate technology (Marshall & Ross, 1989; Rubin & Rubin, 1995). I asked teachers to reflect on their role as a teacher, staff development, technology, and teacher technology training (Appendix C). Each interview lasted approximately one hour and was conducted in the classroom or another suitable room at the participant's school. Questions allowed for discovering "the properties, dimensions, conditions, and consequences" of using or not using technology in order to "flush out concepts and their relationships" (Strauss & Corbin, 1998, p. 66).

Interviews were face-to-face which enabled me to establish rapport with the respondents and allowed me to observe as well as listen (*Designing Structured Interviews*, 1997). Interview questions were broad enough for participants to express their thinking and knowledge yet narrow enough to provide specific data for analysis as suggested by Rubin and Rubin (1995). Each interview was audio taped to record participant responses. Based on the survey results and interviews, I chose four participants to observe.

Observations

Patton (1987) relates four advantages of observations: (1) gaining an understanding of the context of the activity, (2) allowing for an inductive approach by engaging in a firsthand experience, (3) seeing things which others may not consciously be aware, and (4) learning about things which the participant may not be willing to discuss.

After interviewing the teachers, I wanted to observe how the teachers managed their classrooms, the atmosphere they created for learning, and how they used technology.

My degree of participation varied during the observations. For the most part I was an onlooker. Students were aware of my presence but I was not introduced to the class. Three of my observations took place in classrooms where the teacher demonstrated a high degree of integration on the survey and during the interview. The final observation was in a classroom where the teacher did not indicate a high degree of technology integration during the interview but indicated proficiency in computer skills. I intended to describe and compare the classrooms of the four teachers.

Pragmatic validation can be used to verify whether or not a statement is accompanied by action (Kvale, 1996). Based on answers to the survey and statements made in the interviews, I wished to validate what teachers said about technology. I wrote memos promptly after each observation in an attempt to provide an accurate account of how the teachers used technology with students. I focused on describing the elements of setting, social interactions, activities, informal interactions, and nonverbal communication as suggested by Patton (1987) so data would be manageable and relevant.

Data Analysis

The audio taped interviews were reviewed and portions of the tapes transcribed. I transcribed verbatim when the participants responded directly to the questions. I did not transcribe the conversation if it did not apply directly to the questions. The transcribed sections of the interviews were coded. "Coding is the process of grouping interviewees' responses into categories that bring together the similar ideas, concepts, or themes you have discovered, or steps or stages in a process" (Rubin & Rubin, 1995, p. 238). The

transcribed lines were numbered. Brackets were placed around main ideas and their modifiers. Words used by the participants signifying main ideas were written in the margin by the corresponding lines of the transcribed text. Code sheets were made for each participant. Trees were used to group responses into themes. Themes and the frequency of responses were grouped by questions from the interviews. Interview responses were then compared to the survey to see if interviews and their surveys about how teachers learned about technology were consistent with greater technology integration in classroom practice.

Surveys also provided insight into the characteristics of teacher participants who professed to use technology. I believed their responses would be similar since all of them demonstrated an interest in technology by applying for teacher technology training. Teachers were expected to be competent in basic technology skills before submitting the application.

Validation

One problem inherent in qualitative research is obtaining knowledge that is reliable. Kvale (1996) describes the interview process used in research:

> The use of the interview as a research method is nothing mysterious: An interview is a conversation that has structure and a purpose. It goes beyond the spontaneous exchange of views as in everyday conversation, and becomes a careful questioning and listening approach with the purpose of obtaining thoroughly tested knowledge. The research interview is not a conversation between equal partners, because the researcher defines and controls the situation. The topic of the interview is introduced by the researcher, who also critically follows up on the subject's answers to his or her questions. (p. 6)

Triangulation assists in maintaining credibility. Patton (1987) discusses four basic types of triangulation: (1) data triangulation-the use of a variety of data sources, (2) investigator triangulation-the use of different evaluators, (3) theory triangulation-the use of

multiple perspectives to interpret data, and (4) methodological triangulation-the use of a variety of methods to study a problem. I used data triangulation by interviewing teachers who taught a variety of subject areas, represented different grade levels, taught in different school districts, and represented different schools within the districts. I used methodological triangulation by using interviews, surveys, and observations to collect data.

Although the interviews were relaxed and informal, my questions were designed to delve into the nature of teachers who professed to integrate technology. As a means of validating data, audio tapes were transcribed verbatim as they pertained to answers that were directly related to the questions. This helped maintain validity by reducing the likelihood that the interviewer misinterpreted the intent of the interviewee or engaged in selective interpretation. Sometimes I rephrased comments made by the interviewee to verify interpretations. On occasion, I summarized comments to allow the interviewee to affirm, deny, or clarify the interpretation. Member checks were accomplished by emailing or giving each participant a copy of the transcribed interview. I asked them to review it and contact me if they disagreed with my interpretation of our conversation (Appendix G). Having been through the teacher technology training, I had a clear understanding of the content and hands-on activities. This added to my understanding of the comments made by participants.

Generalizability was not the goal of this study. It was my goal to "construct as thick and detailed a description as possible of his or her particular setting and circumstances so that others who encounter his or her description can determine its possible applicability to their setting and circumstances" (Kavle, 1996, p. 245). In many ways, I was trying to determine if other teachers had experiences similar to mine at the Professional Learning Center.

Summary

The interpretive approach in qualitative interviewing as defined by Rubin and Rubin (1995) allowed participants to share how they improved as teachers and to what extent they used technology in their teaching. McKenzie's survey indicated participants' level of comfort and proficiency in using technology. Observations served to validate interview responses and offered insight into teaching styles and classroom behavior.

CHAPTER IV

PRESENTATION AND ANALYSIS OF INFORMATION

The previous chapters explained the purpose of the study, provided an in-depth review of literature and research relating to technology and learning, and described the methodology that guided this study. This chapter examines the purpose of the Professional Learning Center, the design of teacher technology training, and introduces the teacher participants through interviews and observations. Analysis occurs throughout the presentation of information. Responses from the survey, *The Technology in My Life*, are given as they relate to technology and staff development issues.

Interviews occurred in the classroom during planning time or after school, depending on the preference of the participants. All teachers had computers on their desks, were networked within the district, and had Internet access. Five teachers had multiple computers in the room for student use. Participants filled out the survey before beginning the interview. Interviews lasted approximately one hour and were audio taped. Participants were told confidentiality would be maintained. I used fictitious names when presenting teachers' responses. Based on the interviews, I observed three teachers I believed integrated technology and one who used technology but not as a tool for teaching with students.

In the beginning stages of the research, two questions guided the interviews and observations: (1) If teachers complete the teacher technology training staff development session at the Professional Learning Center, will they integrate technology in their

teaching? and (2) If teachers complete the teacher technology training staff development, will they move to the stage of Teacher as Leader? Interview questions addressed the following: 1. How teachers improved and the components of staff development that aided in teacher improvement, 2. Teacher's experiences with teacher technology training, 3. Day-to-day use of technology, 4. Changes in teaching as a result of using technology, and 5. How teachers shared their technology expertise. After examining the data, the focus shifted to the following questions:

(1) What are the beliefs of teachers who use technology?

(2) What do teachers who use technology value in staff development?

(3) How does the use of technology change teaching?

As I will discuss later, teachers who integrated technology were leaders because of their beliefs, what they valued in staff development, and changes they made in teaching.

Rather than presenting all the data and then analyzing it, I will present portions of the data and analyze concurrently. Presenting portions of the data and analyzing concurrently illuminates the themes which emerged from questions concerning the impact of staff development for technology integration. The presentation and analysis begins with a discussion of the Professional Learning Center: how it began, why it was created, members represented, and its design for staff development. The 12 teacher participants are introduced in the second section: what they taught, how long they had been teaching, and their comments on teaching, technology, and staff development. The data from the introduction of participants conveyed the importance of staff development and the use of technology. The reader gains insight into how participants viewed their role as teachers and how technology improved teaching for those who used it in face-to-face teaching. After listening to the interviews it was apparent that those who teach with technology had similar

beliefs on staff development, technology, and the role teachers should play in the classroom.

The third section gives pertinent information on teacher technology training at the Professional Learning Center: the expectations of those applying, the lessons and projects participants experienced in the training, and the philosophy, design, and intent that shaped the training. The analysis of the data comparing skills taught at teacher technology training and what teacher participants did with the skills they learned in the training resulted in the forming of two groups: those who used technology to extend their own learning and those who used technology in face-to-face teaching to enhance student learning.

The fourth section presents data on the beliefs of teachers. It is divided into the following themes for analysis: commitment to learning, responsibility for preparing students for life, and receptivity to change. The fifth section presents staff development and the components teachers believed improved teaching: technology related workshops, opportunities for collegial relationships, opportunities for additional technology training and mentoring, and extended time for experimenting with new learning.

The sixth section presents the changes in teaching because of using technology to teach: transformation of the classroom, the presentation of information, and the concern teachers had for students and their needs. The data and analysis result in a comparison of the teaching that took place in traditional classrooms to the teaching that took place in classrooms integrating technology. Teachers who used the skills and lessons learned in teacher technology training to teach students changed the way they taught.

The seventh section revisits the notion of teachers as leaders and how teachers involved their peers in technology. The data and analysis show that because of the

importance teachers placed on technology in the classroom, they took on the role of leader and mentor to both peers and students. In the eighth section the data and analysis led to a summary of teachers who integrated technology in their teaching.

Presenting one form of data and then analyzing it concurrently provides themes for the following areas: staff development for improved teaching, the beliefs held by teachers, and changes that take place in teaching when technology is integrated.

The Professional Learning Center

The Professional Learning Center is part of a City County Professional Development Consortium (CPDC). It was created in 1998 as an effort to promote staff development that would encourage technology integration through effective, innovative teaching. The Professional Learning Center provides staff development to over 9,000 teachers and educators. Funding comes from House Bill 1815, The Telecommunications Act, passed in 1996. There are seven consortium members representing higher education and 19 public school district members. Training is free for the teachers who teach in schools that are members of the consortium. Each school represented has a member on the advisory board. That member reviews applications for the various staff development opportunities.

The Professional Learning Center is a technology and staff development facility for educators. It is centrally located to the surrounding school districts and higher education institutions in the area. It is conveniently located close to a major highway and expressway. Once off the busy highways, there is sufficient parking available. Several restaurants and fast food eating establishments are located within a mile radius. The main classroom and computer lab are lined with windows offering a panoramic view of the city.

The receptionist greets participants as they come off the elevator and directs them to the classroom where their staff development session is held.

Staff development usually begins in the large classroom. The walls have a blue-gray marbled finish that creates a pleasant atmosphere. The room is well lighted and inviting. There are five rows of long tables. Padded chairs face the head of the classroom where a large screen is the center of focus. The latest in multimedia equipment is poised in the center of the room, ready to deliver pertinent information.

The computer lab has ample workstations in PC and Macintosh format, allowing participants a choice of formats. The computer stations are aligned in pods of four. Eight pods are scattered about the room with computers lined against two walls. Printers are available for participants. The room is large enough for facilitators to move about and assist as needed. There is a large screen so participants may watch the demonstrations by trainers. Printers and scanners are available if participants wish to bring material to incorporate into a presentation or print out information for further use.

Teacher Participants

Teacher participants were secondary teachers representing four school districts. They taught social studies, science, language arts, and business to students in grades nine through 12. There were two males and ten females. Their years in the teaching profession ranged from five to 30 years. All of the teachers had completed teacher technology training at the Professional Learning Center.

Ms. Long

Ms. Long taught social studies for more than 12 years. When asked how she improved as a teacher, technology was at the top of her list. Technology enabled her to

provide visual activities in order to hold the interest of her students. Because she liked students to see and experience different sources, she enjoyed sharing instruction with other people through slides, the Internet, CD's, and other mediums of technology. She believed on-site staff development activities for technology were not productive because she needed to get away from her responsibilities at school to really learn how to use technology. Repetition raised her comfort level with technology.

Ms. Martin

Ms. Martin, a second career teacher, taught language arts for five years. She said she improved as a teacher by devising a project and then doing it herself so she could understand what her students would experience. She preferred staff development activities featuring technology. When considering staff development, she expected to come away with something she could "turn around and use the next day." She used her creativity to take lessons designed by other teachers using technology and incorporate them into her own classroom activities. She learned every time she attended or presented a technology staff development activity. Her goal was to have students use technology in her classroom because they were surrounded by it in all other aspects of their lives.

Ms. Monroe

Ms. Monroe was a veteran science teacher of more than 20 years. She said she improved as a teacher when she could furnish students with the freedom to "do it, touch it, feel it, instead of just hearing about it." Technology enabled her to provide those experiences. One-hour, one-shot staff development was a waste of her time. The biggest change in her teaching was moving from presenter to facilitator as she shared the role of teacher with students and research labs or universities around the country. Teaching with

technology was new to her but she worked harder to integrate technology because her students would be exposed to technology the rest of their lives.

Ms. Allen

Ms. Allen had been in the teaching profession for 15 years. She said she was a better teacher when she had something like technology to help her get organized. Technology kept her from shuffling papers around and she could display what she was talking about to her audience. She learned best by watching someone else and then doing the task herself. She liked activities she could share with other teachers. Hands-on activities in small groups of teachers with similar skill levels were most beneficial. As a teacher she enjoyed helping students find information, bookmarking sites on the Internet, and preparing resources for teachers. She appreciated having the variety of resources technology provided.

Ms. Brown

Ms. Brown taught science for almost 20 years. Using technology saved her time because she kept her notes on PowerPoint instead of writing them on the board each day. Notes in an electronic format were printed out for students so they could concentrate on what was said without "trying to copy everything down." She said she was a better teacher because she asked for feedback from the students. She tried to adjust her teaching to the needs of the students. She used the Internet to communicate with students and keep them up to date on assignments and announcements.

Ms. Noble

Ms. Noble believed that after 23 years of teaching she improved through her "life experiences." Watching her own children grow up made her focus on students' lives as a whole, not just academics. As a student working on her doctorate, she found she learned

best when her professor let her be in charge of her own learning. She used that philosophy in conducting her classes because she said, "I know where I am going and so do many of my students." Technology was an avenue for her to combine her creativity with her subject area. She used technology to enhance the understanding of science concepts and lab experiments for students. She desired staff development that was long term, away from school, and concentrated so she could focus on learning.

Ms. Elder

Ms. Elder began her teaching career in her mid-forties. After teaching for 5 years, "trial and error" helped her the most. She improved through collegial relations with other teachers who taught language arts. She used technology to gather background for her lessons such as "why Milton might have written *Paradise Lost*." She said she had long days and needed practical staff development that "got a full hour of stuff out of that hour." She referred to herself as an "early adopter" when it came to technology. However, Ms. Elder said it took time to develop technology lessons and she did not like the fact that you had to "take students out of the classroom where you have all your materials."

Mr. Masters

In 30 years of teaching science, Mr. Masters participated in many technology staff development activities. He passed on to students what he learned at technology workshops whether it be new ways of finding information or immediate opportunities to gain understanding during science classes. He commented that to really learn something you needed to teach it, so he often had students do the teaching. He liked to try new things, incorporating what worked and throwing out what did not work. He changed aspects of his teaching every year.

Ms. Maple

Ms. Maple taught business courses in three districts for nearly 30 years. She said she told her students to get as much technology as they could because technology would figure in no matter what field they picked. With technology her students had access to the most current research; resources the school district could not provide without technology. Staff development that provided opportunities to talk with other teachers inspired her creative nature. She recognized that students had changed from when she was a student. "Kids are fast paced; they want it now, they want it to happen, they can't sit."

Mr. Rogers

Mr. Rogers was a second career teacher. He was in banking before becoming a social studies teacher eight years ago. He said he improved by critiquing facilitators and teachers to determine what he should do as a teacher. Although he said he was not creative by nature, technology opened up opportunities for him to be creative in the classroom. He believed staff development should be "need driven rather than requirement driven." He said he incorporated technology into his pattern of lecture, homework, test mentality because that is where the kids were today. Regarding his students, Mr. Rogers believed he had a responsibility to tell them more than history facts. "I try to relate it to their daily lives and teach them skills they will need."

Ms. Cooper

Ms. Cooper taught language arts for five years. She changed her traditional way of teaching to accommodate students who did not want to be in school. Finding creative ways to teach were important to her. She believed teachers should put in extra time beyond the school day to "learn the tools you need." She modeled what she wanted her

students to do. She learned to use computers by teaching about them. Her students were engaged most when they could choose topics of interest and learn using technology.

Ms. Young

Ms. Young taught science for six years. Her teaching improved when she participated in staff development activities that gave her materials to use with her students that were "outside the textbook." She disliked 'abstract' staff development that did not "give you what to do" because she could not apply it to her class. She referred to technology as a resource she used in her teaching.

Summary of Teachers

All 12 teacher participants used technology and wanted practical staff development opportunities with hands-on activities that resulted in a product to use in the classroom. Differences began to emerge when teachers discussed how they used technology in their teaching, whether or not they shared the responsibility of delivering information with others, how they improved as teachers, and the relationship they had with their students.

When talking about technology and teaching, all of the teachers but Ms. Elder and Ms. Young used technology in their face-to-face teaching with students. The majority of teachers spoke of ways they used technology in their classrooms with students. Ms. Martin planned activities that students could do using technology. Ms. Long and Ms. Monroe spoke of the visual opportunities available with technology to enhance instruction and learning for students. Ms. Allen and Ms. Brown used technology when they made presentations to classes because technology saved them time and helped them get organized. Ms. Maple took advantage of all the current journals and resources available for her students when they researched topics. Mr. Masters passed on his technology skills

to students by having students do multimedia presentations. Mr. Rogers used technology when he taught his students in an effort to alter his traditional teaching habits of lecturing, giving tests, and assigning homework. Ms. Cooper found that her students read more if they chose their topics and used technology to read. Ms. Elder and Ms. Young never talked about using technology when they were teaching students. Technology served as a resource for researching topics they incorporated into their teaching. This reflected the differences in how teachers defined technology integration.

When teachers were asked how they improved as teachers, all participants but Ms. Elder and Ms. Young singled out technology as the driving force in their improvement. Ms. Elder and Ms. Young spoke of improving through collegial relationships with other teachers and finding resources that went beyond the scope of the textbook.

Ms. Elder and Ms. Young did not mention sharing the role of teacher with experts in the field via the Internet, through software, or by having students do multimedia presentations. Ms. Long, Ms. Monroe, Ms. Allen, Ms. Noble, Ms. Maple, and Ms. Brown wanted students to experience the variety of information sources available when using technology. Ms. Martin, Mr. Masters, Mr. Rogers, and Ms. Cooper incorporated multimedia projects students constructed in their teaching.

All the teachers except Ms. Elder and Ms. Young spoke about the relationships they had with their students. The needs of their students were taken into consideration when they reflected on their teaching whether it was responding to a student's search for information or adapting their teaching to the needs of students. Ms. Martin, Ms. Monroe, Ms. Maple, and Mr. Rogers believed they had a responsibility to use technology as a way of preparing their students for life.

Teacher Technology Training

The teachers who applied for teacher technology training were expected to have level 1 competencies which included the following abilities: managing folders, files, and changing settings; basic computer literacy skills (word processing, databases, desktop file management); working within a document using copy, move, delete, save; developing a presentation; research using an online search engine; having equipment and connectivity for practice and use (Appendix F). Participants indicated their competency in the following areas: basic computer operation, file management, word processing, spreadsheet and database use, graphics use, telecommunications use, web browser operation, Internet research, and the understanding of ethical use. The application included three references and narrative responses to the following:

1. Explain your reasons for applying for teacher technology training.
2. What issues do you see as pertinent when working with learners in the area of technology?
3. Why do you consider yourself a viable candidate?
4. In your opinion, how does the use of technology transform student learning?

On the first day, teachers selected to attend teacher technology training were directed to the large classroom. Nametags were placed around the room indicating a planned seating arrangement. Notebooks were on the tables filled with materials and agendas for the four-day session and space to make notes. Off to the side of the room stood a table with an array of delectable sweet rolls, bagels, and doughnuts. Coffee and water were provided; pop machines were available in the building. Participants were welcomed promptly at 8:30 followed by introductions and announcements. After the brief welcoming session and first lecture, participants moved into the computer lab.

Teachers had the choice of using a computer in a PC or Macintosh format so they could work with computers they had at school or at home. Some demonstrations occurred in the computer lab, but most of the lab time was reserved for teachers to practice what they learned from sessions in the classroom. Lecture, demonstrations, and hands-on activities alternated throughout the day. The teacher technology training schedule incorporated several breaks enabling participants to move around, ask questions, or collaborate with others. Teachers enjoyed the 60 minutes allotted for lunch. To quote one teacher, "What a break! You get to go out and have lunch. I feel like a true professional. I am treated like one, and I am learning skills that are worthwhile" (Ms. Cooper, January 2001). Although the day's session was over at 3:00, teachers could stay until 6:00 to work on projects or practice what they learned. The lessons included demonstrations by teacher trainers and were followed by hands-on practice.

Lesson 1: Using Technology in Your Classroom demonstrated the benefits of effective presentations both in the classroom and on web pages. Suggestions assisted the participants in creating projects that were aesthetic as well as informative. Participants viewed web pages on the Internet comprised of classroom information as well as curriculum-based teacher resources.

Lesson 2: Managing the Internet in Your Class used teacher trainers to model effective search strategies and introduce search engines. With an understanding of effective presentations, participants began the hands-on process of searching for sites to incorporate into their own projects. Participants learned how to set bookmarks and organize them into folders.

Lesson 3: How to Organize Your Class to Use the Internet showed participants how to evaluate sites for credibility and effective design.

Lesson 4: Managing the Internet in Your Class with the Track Star Web Site introduced teachers to a site that allowed teachers to make their own lessons or use lessons other teachers have created. Teachers could search by subject areas and grade levels. Track Star was one of the required projects participants completed during the session.

Lessons 5 & 6: Instruction Design Format and the Five Components of Instructional Design showed teachers how to analyze the objectives of the lesson, choose the information desired, use appropriate technologies to deliver the information, and implement, assess, and revise the lesson as necessary.

Lesson 7: Using Great Presentation Graphics involved the discussion of the visual effects of presentations. Such elements of "see-ability" regarding fonts, backgrounds, size of lettering and graphics, impact of visuals, types of graphics, and alignment were considered.

Lesson 8: Incorporating Multimedia in the Curriculum introduced teachers to such tools as scanners, digital cameras, and LCD projectors to assist teachers in creating multimedia presentations.

Lesson 9: Copyright Basics discussed the issues of fair use and giving proper credit to multimedia that teachers might use when they developed their own projects.

Lesson 10: Web Page Tutorial explained the components of a web page. Steps for creating a web page included showing how to use the tool bar, add text and graphics, edit, create links to other sites, and incorporate email. Sites for copyright free clip art and sounds were given as well as sites allowing participants to publish web pages free of charge.

Lesson 11: Web Page Design had teacher trainers discussing the advantages of creating web pages to enhance student learning. Ideas were given about integrating new resources into the existing curriculum as well as the kinds of information to include on a class web page.

Lesson 12: WebWhacker was used to show teachers how to capture web sites and store them on the computer for future use in the classroom. Teachers could prepare sites to use with students and have them available without being online.

Lesson 13: Understanding the Distance Learning Environment enabled teachers to appreciate the components of distance learning. Video-conferencing brought the outside world to the classroom. Learning comes from a primary source when experts in the field are used to teach students in the classroom.

Lesson 14 & 15: Instructor Tips for the Distance Learning Environment demonstrated what adds and distracts from this type of learning environment. Teacher trainers gave tips to promote variety and interactivity.

Lesson 16: Managing the Internet in your Classroom presented a variety of collaborative activities such as listservs, newsgroups, "ask an expert," email pals and other online projects available to teachers.

Curriculum Project 1: PowerPoint Integration allowed teachers to prepare a presentation using PowerPoint. Presentation storyboards were included in the notebooks for designing the presentation. Participants were introduced to wizards and templates, or could create their own format. Teachers used the sites they explored to import clip art, sounds, or create animation.

Curriculum Project 2: Building an Individual Web Page gave teachers the opportunity to create a vehicle for communication with peers and students.

Curriculum Project 3: Developing a Virtual Field Trip assisted teachers in transporting students beyond the four walls of the classroom. Teachers could share teaching with experts in the field as well as provide experiences students could not have if confined to the classroom.

Teacher technology training is one avenue used by the Professional Learning Center to support collaboration and to nurture and sustain education improvement for students in the surrounding districts. Curriculum is based on constructivist instructional methods in which prior experiences shape learning. Tasks are designed to be meaningful and authentic. Teacher trainers demonstrate how to do a project and then teachers construct an activity to use in their teaching. Teachers take an active role in creating what they deem meaningful in their classrooms.

A cooperative learning environment is an important concept both during the training and once training is completed. Staff and teacher trainers train and offer support to learners. They build on the notion of a community of learners. The teacher trainers are skilled in technology and teach different subject areas. They model innovative teaching practices. Specific skills are taught so that teachers may use such software as PowerPoint, Track Star, and Netscape Composer to develop projects from lessons they have previously created. The goal is to use technology as a vehicle to enhance learning. Teacher trainers act as a support group to mentor and assist teachers as they adjust to the new techniques of teaching with technology.

Design of teacher technology training

The intent of teacher technology training is to show teachers how to effectively use technology in the classroom. Teacher trainers demonstrate technology software and hardware as well as online sites in an effort to acquaint teachers with resources to integrate

technology into classroom teaching. The agenda for each day's session recognizes the need for instruction coupled with adequate time for exploring new learning, and the necessity to tailor activities to meet the needs of each participant (Glickman, et al., 1995; Bransford, et al., 2000; Maier & Warren, 2000; Roblyer & Edwards, 2000). Participants are equipped with a notebook to follow each lesson. Pages are filled with pertinent information and room to take notes so teachers may refer back to their notes and develop activities at a later date.

Teacher technology training delves into the issues of copyright, effective use of the Internet, strategies for presenting information, distance learning, and recreating lessons to fit the teacher's subject area. These broad concepts are individualized when the teacher begins the hands-on activities immediately following the demonstrations. Teacher trainers model a variety of innovative teaching methods. Being project oriented, teacher technology training fulfills the desire of participants who stress the need for staff development that is practical and want a product they can take back to the classroom to use immediately.

Teacher technology training follows the design for learning in which trained teachers provide the instruction for peers (Boreen & Niday, 2000; Cochran-Smith, 2000; Feiman-Nemser, 2001). It recognizes that training educators to use technology effectively must include evaluating electronic sources and sites if technology is to enhance instruction. Sessions emphasize the responsibility that goes along with using technology by discussing copyright and fair use. Teacher trainers provide support as well as instruction while participants develop their skills. As many participants reiterated, there is the opportunity to go beyond the basics if one so desires. Teachers interviewed mentioned the importance of being in an atmosphere conducive to learning.

To receive a certificate of completion, participants must present their web page, PowerPoint lesson, or virtual tour to the rest of the group. Teacher trainers assist with the equipment while participants present their projects. Completed projects are more than a culminating activity. Observing each project reaffirms the numerous possibilities technology affords teachers who wish to integrate technology into classroom practice.

Teacher technology training fosters the notion that teachers need support once they experience technology training. Teachers completing teacher technology training are to be mentors or resource persons at their respective schools for modeling technology integration. Teachers completing the training are equipped with the skills and knowledge to use technology in their day-to-day teaching. They have learned to do the following: design multimedia presentations and web pages; find useful sites for classroom research, virtual tours, clip art, and sound; evaluate sites and organize them for classroom use, use such tools as PowerPoint, WebWacker, and Track Star; collaborate through email, listservs, newsgroups, etc.

The goals of teacher technology training are to encourage technology integration, demonstrate innovative teaching, and improve teaching and learning. Innovative and improved teaching both suggest teaching in a different manner and to some degree, breaking new ground or being on the cutting edge of classroom practice. Given the goals of teacher technology training and the technology skills teachers learned in the training, teachers who have completed the training should be ideal candidates for research involving technology staff development and leadership.

Teacher technology training skills and technology use by teachers

In an effort to illustrate how teachers used the skills they learned in teacher technology training, a list of tasks they incorporated into their day-to-day teaching is summarized from interview data.

Ms. Long: search engines, bookmarks, site evaluation, listservs, PowerPoint

Ms. Martin: search engines, listservs, PowerPoint, web page, Track Star

Ms. Monroe: search engines, listservs, PowerPoint, digital camera, video conferencing, subscription service

Ms. Allen: search engines, bookmarks, site evaluation, listservs, PowerPoint, subscription service

Ms. Brown: search engines, PowerPoint, web page

Ms. Noble: search engines, bookmarks, listservs, PowerPoint, site evaluation video conferencing, subscription service

Mr. Masters: search engines, PowerPoint, Track Star, digital camera

Ms. Maple: search engines, listservs, PowerPoint, site evaluation, video conferencing

Mr. Rogers: search engines, bookmarks, listservs, PowerPoint, web page

Ms. Cooper: search engines, bookmarks, listservs, PowerPoint, web page,

Ms. Elder: search engines, listservs

Ms. Young: search engines, web page

The teacher technology training curriculum assisted teachers in developing technology skills for gathering research for teaching, communicating with other professionals, teachers, and students; and presenting information that enhanced teaching and learning. Gathering information to enhance teaching required the use of effective

search engines and then setting bookmarks for useful educational sites. Technology skills for online communication enabled teachers and students to correspond with experts in the field. Listserves gave teachers an opportunity for collegiality as they shared information. Communication through web pages involved parents and students in the responsibility for learning. Skills in software programs such as PowerPoint, Inspiration, and Track Star assisted teachers in presenting information that was more interesting, flexible, and creative.

All participants used the skills they learned in teacher technology training for researching online to extend the material in the textbook. Nine of the 12 participants joined listserves to foster collegiality and enhance teaching. Five created web pages to communicate with parents and students. Ten teachers said learning to use PowerPoint changed the way they presented information in their classrooms.

Proficiency with technology

The survey *The Technology in My Life* revealed how proficient teachers believed themselves to be with technology. Section A asked them to rate their competency High, Medium, or Low in ten questions concerning the use of technology and the level of importance they held for each skill. Section B asked them to strongly agree, agree, disagree, or strongly disagree on 20 questions relating to how they felt about learning new technologies and programs. Section C asked them to rate their feelings of proficiency High, Medium, or Low on 12 skills using technology. Table I reflects the responses of the teachers to the questions on proficiency in various activities using technology.

TABLE I

Teachers' beliefs on their level of comfort with the following activities

Activities	High	Medium	Low
Using basic functions with confidence (menus, windows)	11	1	
Knowing how and when technology might enhance teaching	11	1	
Using technology for research, communication, presentations	7	5	
Using productivity tools (word processing, databases, print-graphics)	9	3	
Searching with electronic periodicals or Internet search engine	8	3	1
Using electronic mail or listservs to communicate and learn	8	3	1
Employing electronic tools (attendance or grading programs)	10	1	1
Communicating ideas with desktop publishing program	9	3	
Communicating ideas with PowerPoint	9	3	
Searching for information with CD ROMS	9	3	
Applying Boolean logic to searches to target information	10		2
Expressing ideas with word processing	11	1	
Using databases and spreadsheets to collect and analyze concepts	2	7	3
Creating charts from data to interpret and communicate findings	4	7	1
Modifying images with graphics programs	5	4	3
Using computer simulations as a way of exploring concepts	5	5	2

All of the teacher participants indicated a high level of comfort when they used the computer as a tool for word processing, communicating, or managing attendance and grades. They also felt confident in knowing when and how technology might enhance teaching. They believed themselves to be proficient in using technology to research and target information. Their comfort level decreased when participants were asked about how comfortable they felt using technology to create presentations and charts or when they explored concepts through simulations.

When analyzing the data regarding comfort level with technology, comparisons were made between the teacher participants and secondary teachers who had completed the National Center for Education Statistics Fast Response Survey (1999) *Teachers' Tools for the 21st Century: A Report on Teachers' Use of Technology* (2000). Table II demonstrates that teacher technology training teachers felt better prepared to use technology than the

average secondary teacher. It also shows the importance of teachers having adequate time for staff development for technology. During the four day session of teacher technology training, teachers had a minimum of 28 hours of staff development.

TABLE II

Public school teachers with access to computers or the Internet at school

Feelings of being prepared	**Not at all**	**Somewhat**	**Well**	**Very well**
Secondary teachers	15	50	23	12
Hours of staff development				
0 hours	32	46	15	6
1-8 hours	19	55	20	6
9-32 hours	4	61	25	10
More than 32 hours	1	32	37	29

Beliefs of Teachers

Three themes emerged after analyzing data gathered from interview questions regarding teacher improvement related to staff development activities, experiences with teacher technology training, the day-to-day use of technology, changes in teaching as a result of using technology, and the sharing of technology expertise. The three themes were (1) teachers' commitment to learning, (2) teachers responsibility to prepare students for life, and (3) teachers' receptivity to change.

Commitment to learning

Teachers who used technology were committed to learning. By completing teacher technology training, teachers expressed the desire to improve on the basic technology skills

they had acquired over the years. All of the teachers reflected a high degree of proficiency on the survey question concerning competency in finding their way around computers using menus, windows, the mouse, and other basic functions. All teachers expressed a high degree of comfort and proficiency on the question regarding word processing tasks.

Even though teachers believed they were proficient in basic computer skills, many said they had medium proficiency on survey questions regarding higher level skills such as designing student learning activities and learning strategies associated with technology. There was a difference in responses for Question 4 concerning identifying the connection between information literacy and curriculum goals. Those integrating technology believed themselves to be high in being able to identify the connection between information literacy and curriculum goals. The two teachers who did not integrate technology ranked themselves high in proficiency. The fact that the two did not integrate technology in teaching may explain why they believed themselves to be proficient in identifying the connection between information literacy and curriculum goals. This also suggested a possible difference in the understanding of what constitutes technology integration between those who integrated technology and those who did not integrate.

With a foundation of basic computer tasks, teachers were committed to elevating their skills to higher levels of learning for their students. Based on their willingness to commit to four days of learning and practice at teacher technology training, they searched for ways to improve their teaching. Both Ms. Cooper and Ms. Maple believed finding time to enhance technology skills was important. Ms. Cooper said, "I took everything available in computers that was offered. I don't understand how you cannot put in extra time after school. How else can you learn to use the tools you need?" Ms. Maple recognized the rapid changes in technology and indicated she wanted to keep up.

> It dawned on me every time I turn around technology has changed; or it has grown and gotten better and I have to keep up with it. It's tough; you have to keep up with it. I feel like I am missing out if I don't go to the next workshop or find out about the next new software. (Ms. Maple, January 2001)

For some teachers, their level of commitment extended to giving up time during summer vacation. Ms. Long indicated her preference for staff development when school was out for the summer by saying, "I think it is bothersome to do staff development during the school time, I prefer summer. It is hard to get away from the responsibilities at school and concentrate on other things."

Ms. Maple's commitment to perfecting her technology skills has spanned nearly two decades.

> I did technology in 1983, and in 1990 I started working on workshops. I could expand on what I already had learned. I found every time I got around teachers, I learned things that I could bring back to my classroom and make it a little bit brighter, more interesting. I am a visual learner, so when I can be shown something and given the idea, I am a creative person. I can take an idea and upgrade it. I need contact with teachers. You hear something; you build off it. We [teachers] get in the everyday grind. I get better by expanding beyond my classroom and really looking for things I can do differently. It has changed since we went to school. The kids have changed. They are fast-paced. They can't wait now. They want it to happen, and they can't sit. Even the core teachers have to teach differently. (Ms. Maple, January 2001)

Ms. Cooper expressed her appreciation for the support she received from her principal when he purchased a lap top computer so she could work at home. Over the years her commitment progressed from basic instruction to productive, innovative programs.

> I taught computers because no one else knew computers. I used old worksheets to teach. By teaching it, I learned it so well. Then I taught the kids. I use it all the time. My principal bought me a laptop. I could not put in the hours without it. I take it home and use it all the time. That's how I learn to use programs. Photo Shop is a tough program. I learned it by taking it home and exploring with it. You can't do that with kids in your room. At home I will fiddle while watching television. (Ms. Cooper, January 2001)

Mr. Masters was a science teacher who had been teaching nearly 30 years. In his room there were five student stations as well as the computer on his desk. He was continually learning new techniques related to technology. Mr. Masters demonstrated his commitment to learning by encouraging students in his classroom to teach. He commented, "To really learn something, you need to teach it. If I can get my students to take on the role of teacher to their peers, then they tend to learn and become experts in that area."

Based on their proficiency with computers, teachers who used technology had a firm foundation. They were ready to move forward toward innovative teaching by designing learning activities and strategies associated with technology. They expressed a lack of proficiency in aligning curriculum goals with technology. Their commitment to learning enabled them to give staff development in technology their undivided attention. They experimented with new concepts and skills to give their students the most relevant education possible. Because of their commitment, they recognized the need for continuous learning.

Responsibility to prepare students for life

Teachers who used technology believed they had a responsibility to prepare students for life while they taught their subject matter. They showed interest in their students, taught in a manner that would likely engage their students, and tried to make their subject matter relevant to the world today. While observing Mr. Rogers in the classroom, I noticed that he greeted students at the door to his classroom and inquired about what was going on in their lives. Students settled themselves quickly at their desks before the bell rang and were ready to begin class. After taking role, he asked students four questions about what happened on this day in history, giving specific years when the events

occurred. The students guessed the event. Everyone seemed engaged as hands shot up by several students. One question inquired which state had the first woman governor. The correct student response was Wyoming. The student reasoned Wyoming would be a good response because women could vote there first. Another question concerned a new war technique first used on this date. The answer was Kamikaze pilots. Mr. Rogers told me he used the web page from the History Channel to gather events that happened each day in history. The sharing of the events for the day was a request from his students. Once the review was over, students were on task studying with classical music playing in the background. When asked why he played music he replied,

> Research indicates students retain more of what they read while listening to music. I still use lecture, homework and tests, but I try to fill in some of those missing gaps with technology. I know that's the media of this generation. Whether it's movies, music, or TV; I try to incorporate all of that in my class. I have a CD player in the back. What I have found, not only is it pleasant, not only has research said classical music or complex musical patterns adds to retention, it also helps control sound. They are already listening to something and there is less talking going on. One year I had a boy who sat in the back and complained about the classical music. By the end of the semester he was back there grooving to it. I went to a car lot and the lady I talked to said her son was in my class at one time and now listens to classical music at home when he studies. (Mr. Rogers, January 2001)

Mr. Rogers started each semester by having students fill out an application to be a part of his history class. The application was another way he made history relevant to his students.

> On my first day of class, when the teachers are telling students the rules and handing out information sheets; I hand them an application [for my history class]. I go through the rules. Then I tell them that to get in my history class they have to apply. "This is the homework. Bring it back tomorrow. I am going to grade it in front of you. Fill this out. This information form is in the form of a job application. I want you to assume this is the first career position you are applying for." They have to take it home with them. The next day I grade it. I will have thirty applications. I say, "Let's imagine you want to hire someone for a position. How many applications do you think you will get? Probably 300 to 500 applications. You are the HR [human relations] person. Do you think they read every one of these? Here is how the HR person goes through those applications. Time me." I put the applications into three stacks. I do it in less than a minute.

> The stack with applications that were scribbled on, not signed, I throw in the trash. There is a gasp. Then I go to the next stack. These are the ones that were filled out neatly, completely; with no erasures or scratch outs. They cared enough and wanted to sell themselves. There are usually two to five [applications]. I read these applications. I tell the kids if these applications have skills required, I will invite them in for an interview. If I don't find any in this stack, I will go to the next stack of those not so neat or so thorough. At least they were semi-careful. I teach more than history. Yes, I feel a responsibility to teach them history but also to teach them skills they will need. (Mr. Rogers, January 2001)

Responsibility included the need to acquaint students with technology and the capabilities it provided. Mr. Rogers stressed the importance of exposing students to technology when he replied,

> The kid that is going through school now that does not know how to turn on the computer, or gather information, or organize information with the computer, is going to be lost in the workplace. Even the kids that are going to sell hamburgers will have to deal with some kind of digital device. It is going to get more complex as we go along. Not that there is anything wrong with cooking hamburgers, but you may have a lot of wasted talent. Some kids have more gray matter between their ears than is required for cooking hamburgers. That person could be working on airplanes or cars, or in other technical fields that they would enjoy just because they had the computer technology. To diagnose automobiles now you have to look at the computer and read the analysis. There are very few shade tree mechanics unless you own a very old car. (Mr. Rogers, January 2001)

Ms. Martin and Ms. Monroe echoed his sentiments.

> Kids are technology based. They are so surrounded by technology that in school it is appropriate to give them an outlet for that. In spite of the fact they have all this technology around them, they need to learn the basic tools they will encounter in the business world: PowerPoint, web pages, and communication. (Ms. Martin, December 2000)

> We work harder to see that technology is integrated because we realize that is the life these kids are going to be exposed to and we are still behind. They [students] are freer than I am to use it. They have grown up with it. (Ms. Monroe, December 2000)

Not all teachers who believed technology should play a major role in classroom instruction said it was easy to use. Time and effort were involved. Mr. Masters said, "I may spend more time researching and putting things together, but once it is there it does not take time to present or rework a presentation. I have it all on a disk." Ms. Maple

agreed that technology was hard work, "I am working harder than I ever have." Ms. Monroe admitted to a certain amount of fear connected with using technology when she replied, "I am not as free as the kids are. I am not going to just sit down and begin pushing buttons. I am afraid I am going to crash."

Knowing students are constantly exposed to technology and that the capabilities of technology will only increase, teachers desired to give students technology experiences so subject matter would be relevant and students would be more at ease entering the workforce. The fact that teachers sought to get to know their students established the teachers' credibility in the minds of the students. Students knew the teachers cared. Because teachers were committed to learning and believed they had a responsibility to use technology in their teaching, all the hard work was worth the effort.

Receptivity to change

Teachers using technology were more likely to be receptive to change. They demonstrated their willingness to change by attending staff development designed to teach them how to use technology to teach differently. Those integrating technology changed the way they delivered instruction. Question 7 asked teachers to rate their proficiency and the importance of skills for professional and personal growth relating to such skills as word processing. Ms. Elder and Ms. Young rated themselves High in proficiency and rated the question important. They did not use technology with students. Out of the ten teachers using technology with students in the classroom, four rated their proficiency as Medium. Four believed the skill of using technology for word processing was of medium importance. Ms. Young ranked the importance for Question 9, developing an expanded repertoire of strategies to promote student learning, as Medium and her proficiency as Medium. Ms. Elder ranked proficiency as Medium and importance as High. Seven who

used technology in the classroom ranked the importance as High even though eight out of ten claimed they had Medium or Low proficiency.

Teachers participated in teacher technology training to learn innovative ways to teach with technology. However, for survey Questions 9 and 12 in Section C relating to curriculum issues, they did not rate themselves high overall. With a possible 24 points; seven ranked themselves high, twelve marked Medium, and five indicated they were low in proficiency. On Question 5, Section B, asking teachers if they integrated the use of technologies so fully that they could not function without technology, the two not integrating technology agreed. This was another indication of the differences in understanding of what it meant to integrate technology. Of the ten who did integrate technology into their classrooms, five disagreed, three strongly agreed, and one agreed.

Interviews reflected the desire of teachers to change what they did in the classroom when they believed it resulted in better teaching. Mr. Masters commented, "I continue to do those things that work but modify them. Those that don't, I throw out and try something new. The technology has made it a lot easier to do." Ms. Monroe was aware of making changes but wanted to tie it to improved learning if possible.

> I keep changing slowly and adapt to the new methodology. The problem is I do not take enough time and reflect on the impact it has made on the students. I know that it has, but I'm not sure how much. I can't be concrete with my answer. (Ms. Monroe, December 2000)

Creativity coupled with technology made it easy for teachers to improve their teaching by making changes in materials or modifying them. As teachers prepared and acquired new information, lessons were quickly updated.

> I have gone through the training at the Professional Learning Center. I always learn something there. It is just an ever expanding envelope. Twenty years ago I was struggling with multimedia. Now there is PowerPoint and I can do what I want to do easily. It makes me want to try new things. (Mr. Masters, December 2000)

Ms. Martin changed test questions using technology. She said, "Tests may be different for each class. I use a video projector to introduce lessons and quizzes. It is a fast way to do a different quiz every hour. I can change them up." Ms. Brown adjusted the text information from a CD for advanced students and used portions for her regular classes.

> There is also a CD that goes with the text book. It is in PowerPoint already put together. I have PowerPoint presentations from last year. I will use a single section for my regular students. With alterations, they can use them. This just pops in, has all 25 chapters so I can go to whatever chapter I need. I have videos, charts, movies, animations. (Ms. Brown, December 2000)

Ms. Allen constantly explored new avenues to assist students and teachers with information needs.

> When a student asks an obscure question, I used to think, "Okay, I can look in that reference book or that one." Now I think, "I know I can find it on Electric Library in a second." It is a time saver. I compile resources for other teachers, [and look for] web sites and set bookmarks. I use a listserve to help other teachers with the same problems I have. (Ms. Allen, December 2000)

The two teachers who did not integrate technology into their teaching did not exhibit many instances of change. Ms. Elder learned how to teach differently using web pages, but did not believe it was worth the effort to use her web page. She said, "What I created [web page] I can't use because I can't put it on the school web site. I have been looking to get free hosting. I want study questions on there. Again, it is a matter of time." Although Ms. Young created a web page and posted it, she did not change the way she communicated with parents since she did not know if her web page was even used.

> I did my own web page. I put assignments on it and the kids can access it. Parents were real excited but I don't know if they used it. I did put upcoming projects on it so parents could go and see what will be coming up. Most students have Internet at home. We have a lab but I have not gone to the lab. The English department uses it a lot. (Ms Young, January 2001)

A variety of opportunities were available when teachers were receptive to change. Change could be seen as an opportunity rather than a nuisance. Teachers using technology

sought ways to change their teaching. They were flexible and used technology when it served their purposes, or adapted and made changes when it did not accomplish their goals. Technology made change easier and enabled better learning by adapting lessons to the abilities of the students, changing test questions, and finding better resources for information.

Teachers' beliefs of commitment to learning, responsibility to prepare students for life, and being receptive to change factored into their willingness to explore learning and teaching by integrating technology into the classroom. Teachers valued opportunities to participate in staff development leading to improved teaching with technology.

Staff Development for Improved Teaching

Staff development encompasses any learning opportunity sanctioned and supported by the school system (Glickman et al., 1995). One of the themes that emerged while analyzing data from the interview questions was the kinds of staff development experiences teachers said improved their teaching. The components of staff development that teachers singled out were technology related workshops, opportunities for collegial relationships, opportunities for additional technology training and mentoring, and extended time for experimenting with new learning.

Technology related workshops

All teachers said technology improved their teaching. On survey Question 20, Section B, asking if teachers believed they were prepared to take on new challenges related to technology; four strongly agreed, seven agreed, and one disagreed. No one agreed with Question 16, Section B, saying that they felt they had been left behind regarding technology and did not see what good it would do. On Question 14, Section B, all of the

teachers disagreed with the question that the new equipment and technology was an innovation having little impact on their classrooms or students. Replies from the survey indicated that all teachers were comfortable using technology and believed technology was important. All teachers strongly agreed or agreed on Question 15, Section B, regarding pride in accomplishing new learning using technology and stated that they were ready to share it with colleagues.

Responses differed on survey Question 1, Section B, about the necessity for formal training and pay while learning technology. Two teachers who did not integrate technology strongly agreed, saying the new technologies had been easy to learn and they were eager to get their hands on more equipment to teach themselves. Five teachers who integrated technology agreed and four teachers disagreed with Question 1. Teachers also differed on survey Question 8, Section B, asking if teachers should learn new technology by receiving formal training and pay. The two teachers who did not integrate technology disagreed. Seven out of the 10 participants who integrated technology agreed or strongly agreed that learning new technologies should come with formal training and pay. I believe those who integrated technology supported formal pay and training because of the extra time they spent not only learning how to implement the technology but also adapting it to their lessons and using it with students.

Eight teachers said teacher technology training by the Professional Learning Center increased their comfort level and encouraged them to adapt projects from the training to lessons they used in their classrooms. Teacher technology training expanded the technology expertise of Mr. Rogers, Ms. Cooper, Ms. Brown, and Ms. Monroe.

> I have been able to use the media of technology, Internet, and graphics in a way I would not have been able to unless I had the training. I was just beginning to use a web page. I was going in and copying HTML off someone else's web page in a crude manner. Once I got to the Professional Learning Center, it was like I was

> pulling a wagon and then jumped into a Ferrari. It was a major leap as far as what I was able to do. It helps just knowing the tools and how to use them. The problem I see with training that has been provided in the past is that it is developed because there are so many hours we are required to have. They have to come up with something to fill those hours. It is requirement driven rather than need driven or desire driven. (Mr. Rogers, January 2001)
>
> It helped me to actually build a project. It gave me the framework. I knew how to make it. It expanded my knowledge of PowerPoint. Having teacher trainers available gave me people to go to in order to go beyond what the project was to do. It allows you to get ahead. One trainer can work with you if you wish to move ahead. Having teacher trainers there gives us extra skills. A lot of people have great ideas and want to take it a little further. (Ms. Cooper, January 2001)
>
> People at the teacher technology training really make you feel good. Sometimes when I go to the ones here at school, I get the impression that I am supposed to know that. The people at teacher technology training are perfectly willing to go back to elementary school, figuratively speaking, to get you where you need to be. It is very positive reinforcement. When I went there I knew some basic things such as word processing but I never put a web page together. He [teacher trainer] must have thought I was a total idiot, but he stayed with me until I finished the project. I had trouble and he helped me figure out what I was doing wrong. That is the thing I don't see here at school as much. (Ms. Brown, December 2000)
>
> Teacher technology training makes you comfortable using technology. They teach and show. You hear how to do it and then do it. I am not as free as the kids are. I am not going to just sit down and begin pushing buttons. I am afraid I am going to crash. I appreciate their expertise. When you are there for a week [Professional Learning Center] you can follow through. There are experts right there so when you get stuck or want to find something else, they can come right over to you. (Ms. Monroe, December 2000)

When teachers were asked how they improved, technology was the answer given most often. The teachers felt prepared for the challenges technology had to offer. They believed formal staff development was important as a means of giving teachers additional skills to maximize their abilities and acquaint them with the various tools connected with technology. Teacher technology training created a comfortable, yet knowledgeable environment for staff development training in the use of technology.

Practical, hands-on activities

All teachers believed the most beneficial staff development activities were those that allowed time for hands-on practice and to develop materials or activities to use with students. Several praised teacher technology training because of the hands-on opportunities. Ms. Monroe said, "First they tell you what you will do, then fairly immediately they allow you the time to do it. You don't just hear it and you don't just sit down to the computer and do it." Ms. Elder commented, "It is great training. It gave me time to practice." Ms. Young used the hands-on time to create projects. "Being able to search and play with it a little bit more helped." Ms. Noble agreed. "I prefer those activities that allow me to create what I can do in my classroom once I have learned the skills."

Ms. Allen and Ms. Brown shed additional insight into the value of hands-on experiences.

> It helps when people demonstrate things; they don't just talk about it. [It is] even better when I get to go back and try it. Hands-on is very helpful. Some of the things in our district have helped, but I have to go back and do it to make it stick. Sometimes there are so many people; they are all talking. I feel like I have really wasted my time. If I get a handout and can go through it myself, I am better off. I like what I can take away, use and apply; maybe pass on to teachers. It is a real moral booster and fun. (Ms. Allen, December 2000)

> I like staff development that gives you real hands-on, that tells you this is what you do. Some of the computer ones you do here at school aren't helpful. If the computers work and we really can do it, I find it productive. If it is just a lecture saying, "If this worked" then it is not helpful. (Ms. Brown, December 2000)

Practical staff development was important to participants. Ms. Elder and Mr. Masters commented about the types of staff development they believed resulted in improved teaching. Ms. Elder said, "Things that are practical, not philosophical, not pedagogical. Ideas in handouts to tell what to do when. I don't want people to come in and teach their philosophy. I want to know what works."

> Classroom maintenance is always good, how to discipline. Assertive discipline is good too. I have had some really good discussions on rubrics, grading, etc. Any time the instructor is enthusiastic, I find the staff development activity is better. Those who have been in the classroom and understand the problems are more beneficial. It's the practicality that's good. (Mr. Masters, December 2000)

Teachers wanted staff development that produced something to use in the classroom. They were product-oriented and learned by doing. Practice resulted in effective learning and mastery. Most used their creativity and individual preferences to enhance an idea or activity.

Opportunities for collegial relationships

Teachers valued collegial opportunities. On survey Question 9 asking if teachers desired to learn new things as individuals, only four agreed or strongly agreed. Eleven out of 12 participants agreed or strongly agreed with Question 17 from Section B about preferring to work with teams of colleagues to "build units and lesson plans that translate new tools into something that can be used in the classroom."

Teachers appreciated the informal sharing that occurred during staff development as well as time built into the schedule for sharing with other teachers. Teachers improved as they exchanged ideas face-to-face with colleagues or online through listserves. Hearing other teachers reflect prompted new ideas teacher participants could use to improve in their own classrooms.

> We used to go to teachers' meetings and reflect with each other. I would hear something and think, yes, that would be a great idea. Teachers' meetings aren't that kind anymore. You don't get to visit with people, bounce things off of each other. I find every time I get around teachers I am learning things that I can bring back to my classroom and make it a little bit brighter, more interesting. I am a visual learner so when I can be shown something and given the idea, I am a creative person. I can take an idea and upgrade it. (Ms. Maple, January 2001)

> My best staff development is probably participating in listserves, particularly the AP English. Those are head and shoulders above anything else. The second is the collaboration day meeting with English teachers, sharing what we do in the classroom. I like staff development specific to me. (Ms. Martin, December 2000)

Mr. Masters shared the importance of having teacher trainers available when he commented, "The one-on-one connectivity is really neat at the teacher technology training. The beauty of that is, what one teacher trainer doesn't know, another one does. Everybody understands the trainers are there to help. I always learn something."

Sharing resources and lessons developed for Track Star gave teachers the opportunity for collegial relationships online. Ms. Martin found additional sources to use for her classroom as a result of the Track Star curriculum project she developed at the teacher technology training. She replied, "It introduced me to Track Star which I now use, and search engines I did not know about. All those things have had a ripple effect in all that I do."

Mr. Rogers was working toward national certification. His commitment to learning as well as his belief in the importance of collegial relationships prompted him to set up a web page for peers who were also working on certification. He shared learning, gave support, and demonstrated his leadership qualities through one of his web pages.

> I have set up a web page for a discussion group. Kind of an empathy group for teachers in our state. They can post what they are working on, people can give suggestions. It gives them a place to do that. They don't have to drive somewhere to talk with someone. It is not being used as it should be because teachers are not used to technology. They are afraid of it so I only have a few who are using it. (Mr. Rogers, January 2001)

Collegiality improved teaching. It served to stimulate new ideas and activities and was an avenue to support teachers as they learned. Collegiality energized teachers. Sharing lessons through programs such as Track Star allowed teachers to add to their bank of activities to extend classroom learning. Joining listservs put teachers in touch with other teachers who shared the same subjects and interests.

Opportunities for additional technology training and mentoring

Good staff development design offers opportunities for additional training as well as ongoing technology support. Mr. Masters had taken several workshops offered by the Professional Learning Center and remarked about his experiences saying, "I have gone through the training sessions at the Professional Learning Center. I always learn something there. It is just an ever expanding envelope." Ms. Cooper regularly attended staff development sessions from the Professional Learning Center and said, "You learn the basics and if you want more you can take additional classes to do advanced PowerPoint, etc. This is your starting point." Ms. Long used the web site constructed by the Library of Congress but honed her skills with additional training. She remarked, "I took the Library of Congress training there. It helped me navigate around the site. I want to do additional training over the summer." As site technology coordinator, Ms. Long even scheduled the Professional Learning Center for her teachers during a designated staff development day.

Teacher technology training instructs teachers from several school districts, hoping they will return to their respective schools and mentor other teachers. Ms. Maple offered insight into why teachers needed a variety of people to assist them.

> Teacher technology training gives you a list of people in your class you can call. Their chat line has helped. Some teachers aren't afraid to ask questions. Some people are intimidated by people in the same school and won't ask questions of people they work with. Teachers will call someone from the Professional Learning Center rather than someone from their school. (Ms. Maple, January 2001)

The desire for additional training and mentoring complemented the notion of teachers' commitment to learning and their desire for collegial relationships. The fact that the Professional Learning Center taught basic programs and then offered additional training allowed teachers to choose the activities they wanted to explore further. They had enough information to make an intelligent decision regarding the usefulness of the new

skill. It also reflected the desire for practical staff development stressed by teachers. If teachers did not believe training in a specific area would enhance their teaching, they did not want to waste their time learning. Sharing what was learned with mentors or other teachers made the process of learning more productive and less stressful.

Extended time for experimenting with new learning

Teachers believed they needed sufficient time to get involved with what they were learning. For that reason, many participants preferred to attend staff development activities during the summer or on weekends when they could devote all their attention to the activity at hand.

> Onsite technology staff development is not always helpful. It is difficult to get them completed in the time allotted. Waste of time...? Large groups. I need individualized help. I want to sit at a computer where it is not crowded. The time frame is sometimes difficult. One hour is not enough. (Ms. Long, December 2000)

> We learn from each other at the Professional Learning Center. Teachers bring ideas into the sessions and others learn from them. We had eight hours a day to play and learn. There is continuity by going four days in a row. You get four or five projects you can go back and do. There is a list of people in your class you can call. (Ms. Maple, January 2001)

> I prefer staff development that is long term. The shorter ones don't help me as much. It could be in succession, every day for a week; or one evening for several weeks in a row. Probably I feel I have learned the most when I have a full day to really get down deep with something and I am completely removed from the requirements of the actual school house. After school I am fried, it is not the best for me. For me I have gotten the most out of summer staff development with several days in a row because I can really focus on what is going on and reflect on it before I am back in class. (Ms. Noble, December 2000)

While those who integrated technology stressed the value of extended time to "learn and play," Ms. Elder, who did not integrate technology, remarked that the length of time was not important to her.

> Quick and dirty works for me. I have long days. If I spend time in staff development activities I want to get a full hour of stuff out of that hour. I want new information that pertains to my teaching. (Ms. Elder, December 2000)

When asked what types of staff development were a waste of time or did not result in improved teaching, most mentioned staff development geared to the entire district or ones that were philosophical in nature. Ms. Monroe said, "What is a waste of time? The TQE [Total Quality in Education] workshops. It is a reiteration of what is already known; they want us to use it but don't give us perimeters. It is the newest methodology."

> I am disappointed when we have some high dollar speaker that comes in. When you put a speaker in front of that many people the message changes. They are not going to communicate to those people as they would in a smaller environment. The message does not get across as well. It is not as personal or specific when someone tries to address the whole district. You are less likely to come out of there with staff development you can turn around and use the next day. (Ms. Martin, December 2000)

> It is those staff development activities where my administrator wants me to see the big picture that I find the least helpful in my classroom as far as my teaching goes. I prefer those most directed to exactly my topic, my subject. If it is technology, then I want science and technology. (Ms. Noble, December 2000)

Ms. Cooper offered an explanation as to why teachers did not respond to motivational types of staff development by saying, "I don't need a motivational speaker; I am a motivated teacher already."

The desire for extended time to experiment and practice with new learning was reflected in the teacher's commitment to learning. Learning was reinforced with practice. When teachers practiced with mentors available for support, practice led to mastery as the two shared information and techniques. Teachers who used technology in teaching tended to be practical and valued their time, yet they were dedicated and willing to spend extra time on activities they believed improved their teaching. When teachers spoke of staff development that led to improved teaching, it pertained to activities which involved learning a skill and then using that skill to produce a product for use in the classroom.

Changes in Teaching

When presenting and analyzing data from interview questions, another theme that emerged was the changes in teaching brought about by incorporating technology into the classroom. Changes were grouped into three categories: (1) the ways technology transformed the classroom, (2) how information was presented in the classroom, and (3) the attention teachers paid to students and their needs. Teachers who integrated technology had outgrown the confines of the traditional classroom. Teaching extended beyond the barriers of classroom walls. Technology transported students to sites where experts in various fields of study shared the role of teacher. Teachers were no longer the focus of instruction, or as put by Mr. Masters, "the sage on the stage." They responded to the needs of their students and they shared the responsibility for learning with students. Classrooms where technology served to enhance instruction appeared different from the traditional classroom.

During my observation of Ms. Long, I made note of the technology she used with her students. To present her lesson, Ms. Long used a video player, television, and computer. In order to complete the assignment, students demonstrated their proficiency with the Internet, a scanner, a printer, and a word processing program. During my observation of Ms. Maple, students demonstrated proficiency in constructing a PowerPoint presentation. They could capture pictures and sounds and paste them into their presentations. They experimented with word art from the program. Ms. Maple circulated among the students, making suggestions as she checked their presentations. Mr. Rogers used a CD player and the Internet when I observed his class. He told students to check his web page for assignments. During my observation of Ms. Elder, the only evidence that she

used technology was the computer on her desk. She used it to take attendance and worked with it while students prepared for a coming test.

Teachers who integrated technology modified their teaching. Students and teachers moved freely about the classroom. The discovery approach to learning took place as the students explored topics of interest and shared what they found with other students and with their teachers. Modifications in teaching affected the way students responded in class. Integrating technology transformed the classroom by changing the boundaries of the learning environment, the way information was presented, and how teachers responded to their students.

Transformation of the classroom

Ms. Long met her students in the computer lab the first day after President Bush gave his Inaugural Address. Students were transported via technology to Washington, D.C. so they could experience a portion of the history-making inauguration of the President. She played a video tape of the Inaugural Address given by President Bush. She asked students to access a web site featuring the election and take the quiz provided at the site. Students were invited to go to the web site and follow along. Most students listened to the video tape and followed along on the web site so they could read the speech at the same time.

After watching and listening to the speech, students went to the Library of Congress web site and accessed Bush's speech plus the speech of another president of their choice. Students filled out a worksheet asking questions about the goals or concerns for the country at the time of both speeches. Ms. Long spent the entire hour walking among her students. She made comments about what students found on the web site. She also asked them questions about the other presidents they chose to compare with President

Bush. Students moved freely around the room and looked at other classmates' projects. Students were engaged the entire hour.

Using technology, Mr. Masters had his students mentor younger students in another building. "My students used email to help third grade students with their research. Then we went over and they presented to us."

Ms. Monroe believed she improved as a teacher by providing the real world experiences technology offered. By using technology, she transported her students to a university web site and the genome project. "You are not the only teacher; you are drawing from the experts." She also provided lab experiences via technology.

> I have money to pay for a specific site which gives my students and me access. The labs for AP [Advanced Placement science] are there. Students do a write- up before going into the lab and then take quizzes. It is a way of preparation. They go through the procedure then email me the quiz prior to coming to the lab. I give a deadline and they do it on their own time. (Ms. Monroe, December 2000)

Teachers used technology to communicate with experts outside of the classroom. Ms. Maple said she planned at least one video conference each year.

> We researched a topic and then sent questions to Patel lab. [We had a] video conference with experts in the field of global warming. It was a chance for students to meet and talk one-on-one with a lead scientist. He was impressed with the level of the questions students asked. (Ms. Maple, January 2001)

Teachers mentioned using Track Star and Inspiration with their students. Students were transported to various places when teacher participants used lessons that had links to virtual tours placed on the Internet by other teachers. Many lessons included virtual tours to places students may have read about, but had no first-hand knowledge.

The administrative functions accomplished with technology allowed teachers to have ready access to grades and attendance even when they were in another room such as the media center or computer lab. They could leave their classrooms yet perform required tasks.

Integrating technology allowed for alternative teaching environments. Teachers who did not integrate technology preferred to be confined to the classroom. Neither Ms. Young nor Ms. Elder made the effort to secure lab space. Ms. Young said, "We have a lab but I have not gone to the lab. The English department uses it a lot." Ms. Elder shared her preference for remaining in the classroom where she had her traditional kinds of materials. She remarked, "It is difficult to share technology with the students. I can't get time in the computer lab. Besides, you have to take kids out of classroom where you have all your materials."

Learning was not confined to the classroom setting for teachers who integrated technology. Students could relive historic events and visit sites dedicated to learning. Learning became the focus, not the classroom or the teacher.

Presentation of information

When I observed Ms. Elder's classroom, the marker board was full of announcements to students. Ms. Noble used technology to make announcements to her students. Mrs. Noble said, "When I know there will be a lot of announcements, I will do a PowerPoint with rote announcements. It saves me going back over and over. Before they are even seated, they view my announcements."

When I observed Mr. Rogers, announcements for his class were limited to one line on his board. He put information on his web page for students and parents.

> I have been here about 1 ½ hours and I have already updated my web page. I let students know there is a test next week. I also use it to communicate with students and parents. They [parents] love to know I have a web page and can look and see when the next test is. Then if the book does or does not come home the night before the test, they know what to do. It is interesting being at a parent/teacher conference and the parent says, "I never know when he has homework or when the test is." I say, "Do you have access to the Internet?" and they say, "Oh yeah, [I have it] at work or at home." Then I say, "Let me give you my URL and you can access my web page." Hello! A light goes on. They don't have to hound their student to ask what homework has been assigned. They know. I have a listing on there of all my

> assignments by number. I have the number on the blackboard and they can go to my web page and see what is assigned. Each chapter and the questions are there. They know where to go to do that assignment and what the requirements are. That has all been done before class starts. I add to the web page as the need arises. (Mr. Rogers, January 2001)

Teachers were no longer the sole presenter of information. Ms. Long said, "I like the kids to see and experience different sources." Students had the advantage of instruction from experts in the field as well as from their classmates. Ms. Monroe remarked, "My role has moved from being the presenter to even allowing students to present information. They are getting more adept." Mr. Masters was also a strong proponent of learning by teaching.

> My whole philosophy in education has changed to where it's not so much I am up there teaching. I think in education to really learn something you need to teach it. So, if I can get my students to take on the role of teacher to their peers, then they tend to learn and become experts in their area. Peer mentoring is something I have gone into lately. (Mr. Masters, December 2000)

Because of technology, information was better organized and more accessible. Technology made lectures more engaging for students.

> I am a better teacher when I have something like technology to help me. It gives me confidence when I have something that enhances what I am saying, or helps lead me through what I am saying. I don't like to stand and shuffle papers in front of me. Technology helps me be organized. (Ms. Allen, December 2000)

> When I went to put notes up on the TV they were all typed out and I did not have to take the time to write it on the board. I can also print it off so the kids have it and they are not scrambling to take the notes. Kids don't listen when they are scrambling to take notes. They are trying to get everything down, every word. They can add notes in the margin on the hard copy. They do that very well. Before when I used the overhead, it was a still picture. Moving pictures help convey meaning. (Ms. Brown, December 2000)

Ms. Long and Mr. Rogers believed students were more receptive to history when they could visualize what was discussed in class.

> I have incorporated things in my teaching which makes history more interesting such as History Alive slides. [There are] interactive activities for students to create,

> aids for the teacher, and visual images. It keeps the interest of the students when they can visualize. (Ms. Long, December 2000)
>
> Behind you I have an LCD projector and if I am in the middle of a lesson and I think there is something on a web site, I can show it. It takes two minutes to turn it on and then play whatever you need. I have a number of bookmarks such as the atomic bomb. When I get to that part I can show the atomic testing at Bikini Island with the picture of a battle ship standing on its nose. It is pretty impressive. I have bookmarks for Mussolini's body hanging in the square after he was killed. It brings to life what was really going on. (Mr. Rogers, January 2001)

Technology enhanced the teachers' creativity and increased their ability to make information more meaningful for the students. Ms. Noble admitted to being more creative when she presented information as a result of teacher technology training. She recalled her experience as being "supreme."

> Teacher technology training allowed me to be creative in my element of science. They taught us basics, and then let me break away and be creative on my own and do my science thing. Instead of picking up a book and pointing to a picture, it is plastered up on my wall. The student is able to visualize the process. (Ms. Noble, December 2000)

Teachers believed getting beyond the textbook improved their teaching. For some, that included the use of supplements that go with the textbook.

> There is a CD that goes with the textbook. It is a PowerPoint presentation already put together. I have PowerPoint presentations from last year. Even though it is with the AP textbook, I can use a single section for my regular students. This disk just pops in, has all twenty-five chapters so I can go to whichever chapter I need. I have videos, charts, movies, animation available. (Ms. Brown, December 2000)
>
> I have my favorite CD ROMs that are interactive. They have ten minutes or less of demonstrations, but I can show students using animation or actual materials what happens. I have a VCR in my room to show short subjects quickly. I use a nutrition program that analyzes what students have eaten. There are DNA recombinations students do. It transforms bacteria. I can do genetic crosses and see the new flies. Using the CD ROM's, I can provide things we could never get in a high school. (Ms. Noble, December 2000)

Technology provided easy access to a variety of information sources as teachers prepared their lessons. Finding good sources took less time. Ms. Allen commented on the efficiency by saying, "It is a timesaver. We have more sources available: the Internet,

databases, CD ROM." Sources available with technology were more interesting and up-to-date and saved the school district money. Ms. Maple commented on the advantage of having online sources when she said, "Everything I do centers around the computer. I research. Before I had to use outdated journals. Now everything is more current. No one can afford to have the current journals in business and technology."

Teachers who integrated technology discussed changes in the way they presented information. Ms. Elder's comments during her interview led me to believe she changed the method of gathering information but not the way she taught.

> I mine my teacher editions of the textbook. I do a lot of research into the authors, either in the library or online. I try to reflect the author's time, cultural or political history, and background on literary works. The computer is just a tool. I have always looked at it that way. I am still paper-based in my classroom. I need to see that kids can respond to literature on paper. They need to write answers on paper. (Ms. Elder, December 2000)

Technology was an efficient way to deliver information whether it was used for announcements or for teaching. Announcements were displayed for a shorter amount of time and students needed to pay greater attention. Teaching with technology held the students' attention. Exposing students to many different presenters forced students to evaluate what they were learning and the credibility of the presenters. When students assumed the role of presenter, they gained appreciation for what was involved in the teaching process.

Concern for students and their needs

While observing Ms. Maple, Mr. Rogers, Ms. Long, and Ms. Elder, I noticed a difference in the relationship between students and teachers. Ms. Maple, Mr. Rogers, and Ms. Long moved freely around the room talking with students. They inquired about what was going on in the lives of their students, commented on projects students were doing, and were available to students. Students moved about the room helping other students with

projects. Ms. Elder remained at her desk and if the students had questions, they raised their hand and walked to her desk.

Many of the changes teachers made in the way they presented information reflected their concern for students. They tended to model good teaching and passed on the skills they acquired in technology to students.

> I have done a lot of staff development in computers such as how to use and maintain them. I also learned how to use PowerPoint. Staff development in research techniques, both books and electronic databases, helped me. That helped me pass it on to kids. (Mr. Masters, December 2000)

Ms. Monroe believed she improved as a teacher by providing students with actual hands-on experience. Her students gained a better understanding of science. She remarked, "During labs the students have the freedom to do it, touch it, feel it, instead of just hearing about it."

Ms. Brown was tuned into the needs of her students and incorporated their ideas into her teaching practice. When asked how she improved as a teacher, she commented;

> I have learned to get feedback from my kids. I ask. I have started playing review games and it seems rinky-dink but they love it. I use little blackboards for each student to record answers. They roll dice in groups of two or three and the highest number answers the question. Sometimes they can do it for bonus points. It really doesn't impact their grade, but they review this way. They study the day before the test because they know we are going to play games for review. That way they know what they don't know the night before the test, and what they need to study. (Ms. Brown, December 2000)

Ms. Monroe said both her students and their parents enjoyed seeing one another in the science lab. At the end of the semester students took home their lab presentations on a videotape. She explained, "In the lab I use PowerPoint and take pictures with a digital camera. On Open House night, I take pictures of the parents in the lab to show the students. During Open House, parents have pictures of students in the lab. They both enjoy seeing each other."

Ms. Noble was working toward her doctorate. As a student she realized how important it was for students to direct their own learning.

> Another thing that helped is my experience being a student myself. It is only when the professor lets me be in charge of what I am learning that my learning improves. I know where I am going and so do many of my students. (Ms. Noble, December 2000)

Ms. Cooper searched to find the right teaching style to fit the needs of her students. Her language arts students read more when they used technology.

> I feel fortunate to have had very good professors in education who promoted different types of instruction. I knew I was very conservative, but I did not like that method. For my internship, I actively sought out a teacher who was 100 % opposite of me to get away from the traditional mode in which I was taught. I altered my way of teaching because I had students who did not want to be there [school]. I had to be more creative. I taught the way I learned. A touch of something interesting leads to something else, such as a story of a volcano sparking an interest in studying the formation of volcanoes in science.
> (Ms. Cooper, January 2001)

Ms. Martin believed it was important for her to go through a project before assigning it to her students.

> Whenever I devise a project, I do it myself. It helps me understand what they will go through. I can give step-by-step help. I feel better asking them to do something when I have done it myself. It is just modeling. (Ms. Martin, December, 2000)

Online communication fostered good working relationships between students and teachers. Using blackboard.com made testing less stressful for Ms. Brown and her students. She said, "Over our snow days, students were uptight about not having the review. Another teacher and I set up study questions for them. I actually posted my review on it when I knew we were not coming back."

Mr. Rogers used online communication as a way to evaluate his teaching and to maintain discipline while students were in the computer lab.

> I use blackboard.com like a discussion group. When I take my kids to the computer lab and they finish their work, they have no excuse not to do what I told them to do. On blackboard.com there are several questions about the assignment.

> What did you like about it? What did you discover? They respond to the questions. Then other kids respond to comments made. There is a discussion going on. John Jones says, "It's boring" and then another student says, "Hey, I kind of liked this assignment but I would have changed it and done it this way." It gives me an idea of how I can improve the lesson. They don't know they're evaluating me and there is the added impact that they are busy. The worst thing is having nothing to do in a computer lab because they will find something to do. Idle hands are the devil's workshop. In the computer room it is multiplied by 1,000. There are so many things they can do whether it is going to an inappropriate site or changing the default settings which is just as destructive. (Mr. Rogers, January 2001)

Students had more responsibility in the classrooms that integrated technology. They had input into what topics they would study and assisted with grading.

> That's one of the big changes, allowing the students to choose what is being taught with my guidance. I don't want them off in left field. I still direct their choices, but if they find something interesting, then likely all students will find it interesting such as cloning. Students also give suggestions on how to grade. They really understand what makes a good project. We will discuss what aspects we will be grading. I did not do that at all [before]. (Mr. Masters, December 2000)

Because technology provided easy access to lecture notes, students could catch up on what they missed when absent.

> With my notes and assignments on computer, students have greater access to them. Sometimes if I truly trust a student and they have been absent, they can go back through my notes on the computer themselves. They have become more independent. (Ms. Brown, December 2000)

While all teacher participants used technology to gather materials to teach, only ten teachers used technology as part of the daily activities to support the curriculum and engage students in meaningful learning. Ms. Elder and Ms. Young used technology to prepare for teaching in the classroom, but few changes in teaching emerged as a result of using technology. Ms.Young did not indicate any changes in her teaching.

> I guess for the most part it is a resource. We put grades on it. The kids can have their average just like that. I use it mostly for myself. I would like to get where I use the Internet for research projects. I am not on any listservs. I am on Discovery but it has not helped much. I would like to look into that kind of information next semester. I don't know how my teaching has changed. I used it more with physical science. (Ms. Young, 2001)

Although Ms. Elder professed to be an early adopter of technology, her expertise was limited to using technology to do the same things she had always done. Innovative teaching was not an outcome of the new skills she learned.

> I am completely unafraid of computers. It was my professional experience before becoming a teacher. I brought my computer to the office and used it to do my job. I am an early adopter when there is something new in technology. It is difficult to share it with the students. [I] can't get time in the computer lab. I have to take kids out of the classroom where you have all your materials [to the lab]. I need Internet access and the ability to project it to all students. Do I do PowerPoint? No, because I don't know when I can get the equipment to show it. I am not going to create something I can't use. It is time-consuming to turn lessons into technology. (Ms. Elder, December 2000)

> What I created [web page] I can't use because I can't put it on the school web site. I have been looking to get free hosting. I want study questions on there for students. Again, it is a matter of time. (Ms. Elder, December 2000)

Teachers who demonstrated concern for their students by taking the students' needs into consideration when they taught diverged from the traditional way of teaching. They had relinquished sole power and authority in their classrooms. As teachers sought to supply answers to questions and address the interests of students, they shared the responsibility for learning rather than determining the exact subject matter to be taught. In order to adopt this method of teaching, one had to be committed to learning and receptive to change. Responding to the needs of students reflected the belief that teachers had a responsibility to prepare their students for life and give them the education experiences they needed beyond graduation.

Traditional classrooms versus classrooms integrating technology

Ms. Elder and Ms. Young were still teaching in a traditional fashion. Although they used technology on a daily basis, it was to perform the same functions teachers have always done: taking attendance, keeping track of grades, word processing, communicating. Ms. Elder remarked, "Grades are much easier recorded with technology.

Progress reports are easier." Ms. Young agreed, "Saving grades to the server is great. I still keep a grade book for convenience. There is less paperwork and less writing. I don't need to alphabetize or shuffle through papers."

Ms. Elder and Ms. Young appreciated the administrative capabilities of technology. Those integrating technology did not consider administrative functions important contributions to teaching. Ms. Noble remarked it was not a high priority with her. She said, "Attendance on the computer is so far from what I value the most in using technology."

The differences in classroom management and teaching between an innovative classroom where technology was integrated and a traditional classroom was observed in the way the classrooms were arranged. Arrangement was a key to the kind of teaching that took place. Ms. Elder's classroom resembled the way classrooms have been arranged for decades. Her desk was positioned at the front of the room, facing the students. She was the authority in the classroom. Desks were set in four rows, indicating little group consensus was needed or considered. Near the door sat several folders and trays for student papers. A podium stood in front of the desks with a stool behind it. Assignments written on the board took up much of the board space. A computer on Ms. Elder's desk was the only visual sign of technology or change from the way classrooms have looked for decades.

The three classrooms of teachers who demonstrated the use of technology were not set up like a traditional classroom. Mr. Rogers sat at the back of the room with student desks arranged in a U-shape. He had a computer hooked up to a television set mounted in the corner at the front of the room. Ms. Long also sat at the back of the room with desks arranged in a U-shape. She had five computers in her classroom for student use with one hooked to a television mounted on the wall. Ms. Maple met in a computer lab with

computers arranged in a U-shape around the room. All three rooms lacked an abundance of written instruction. Messages were kept at a minimum and paper trays were not filled with written assignments.

Neither Ms. Elder nor Ms. Young had much to say regarding technology as it applied to their actual teaching. Interviews with Ms. Elder and Ms. Young did not last as long as the interviews with teachers who viewed technology as an integral part of their teaching. They indicated spending a lot of time on their computers, but it was not during class to engage students. The concerns Ms. Elder shared were issues of software and hardware.

> Over the last four years my teaching has not changed too much. The attendance program is time-consuming to use. Grades are much easier recorded with technology. Progress reports are easier. I have a new computer and am able to do much more. Before, the equipment slowed me down. I want to be able to have enough memory to do more than one program. (Ms. Elder, December 2000)

Ms. Elder and Ms. Young saw their roles as presenters of subject matter. The computer served to enhance the gathering of information for teaching. The other ten teachers expressed changes in their teaching because of integrating technology.

Teaching in a traditional fashion does not conform to the teaching practices demonstrated by teachers who integrated technology: extending the classroom to unlimited destinations, sharing the responsibilities of teaching, presenting information in a variety of formats, or taking the needs of students into consideration. As teachers experienced staff development to build their skills in technology integration, the classroom should have reflected a transformation. Information was delivered using a variety of approaches depending on the needs of the students and the availability of teaching resources to present pertinent information. The classroom was expanded to other places throughout the world.

Teachers as Leaders

Leadership proved to be a natural byproduct of teachers who used technology in their teaching. Sherry et al. (2000) credits the teacher as leader with having the skills to develop an awareness of learning outcomes and access how technology impacts students. Ms. Elder and Ms. Young did not progress to that stage. When asked how they shared their technology expertise, all teachers mentioned trouble-shooting if other teachers experienced problems with technology. Sharing the actual teaching with technology was limited to ten of the teachers. Eleven teachers had facilitated technology training, but the training Ms. Elder conducted consisted of email training, not training for teaching.

The ten teachers integrating technology matched the definition of Sherry and others (2000) as they shared their improvements in practice with peers and began teaching new teachers. The teachers spoke of how their own skills were reinforced when they acted as a leader and modeled innovative teaching using technology. They were excited when they collaborated with other teachers and helped them be successful in integrating technology.

> That's why I work so hard to help train teachers. It makes me so happy when I see a teacher come from "I don't know how to turn this on," to "Oh my gosh, I did this, this, and this." It's great! (Ms. Maple, January 2001)

Just as teachers believed they had a responsibility to use technology with students, they believed their peers should also use technology and looked for opportunities to introduce technology.

> You have to train your teachers. The key is if you don't train your teachers, that computer sits because they don't know how to use it, don't know how to integrate it, and don't know how to use the software. So, if you get them over the hurdle of being uncomfortable with the computer, then teach them the software, they are more than willing to work that program into a lesson plan. I have seen that happen in so many [school] systems. (Ms. Maple, January 2001)

Teachers believed technology was a part of life. All teachers should incorporate the use of technology in teaching to compete with students' interests outside of school and make

subject matter relevant. Mr. Rogers shared his notion of why teachers are afraid to integrate technology.

> A lot of it is personal bias. A lot of teachers in their late forties to fifties have never seen the need to get involved with technology. They hope they can retire before they have to get involved. It is a conscious decision. It is a fear of change. It is always something that impacts teachers. If a person has a set routine on how they teach, and it has worked for twenty years, they go, "I don't think I need to do this." They may be six or seven years away from retirement and they think they can just keep plodding along the way they want to. They think, "I can get through this and retire." At the same time they are losing the chance to be more effective with the kids because for the kids, like it or not, technology is going to be the medium they are working in. Teachers not exposing kids to technology because they are not using technology are robbing those kids. Here's another chance they could be using technology, something the kids are going to be living with. (Mr. Rogers, January 2001)

Teachers receptive to change felt challenged when they were able to act as leaders and assist other teachers in changing the way they taught. Ms. Long sought interested teachers who wished to integrate technology in the classroom. She stated:

> [The] technology integration term frightens some people. I talk instead of a project. Let them tell me what they want to do and then I can figure out a way they can incorporate technology. Technology would make it easier for them to do what they want. A teacher and I planned a tour of Oklahoma by going to a tourism web site and planning a route. [I think it is best to] integrate through the backdoor. Technology makes so much more available. Problems occur when the server goes down so I always have a backup. (Ms. Long, December 2000)

Ms. Martin spent much of her time before and after school helping other teachers incorporate technology into their teaching. She often emailed Internet sites to teachers believing other teachers might find them useful. She commented on why she worked hard to solve problems for teachers.

> Most of my time is spent troubleshooting. That's not a waste of my time. I see it as part of my role because I am committed to technology. I believe in technology. If something is not working for a teacher and I can make it work, I am making the teacher more inclined to use technology. That is why I sometimes tell them more than they want to know. I want them to know why it wouldn't work. I am a teacher, not a repair person. I want them to understand next time so they are comfortable with technology. So they can be independent learners. (Ms. Martin, December 2000)

Teachers appreciated collegial relationships and believed technology offered opportunities for creativity. Teacher leaders focused on hands-on, practical projects when they introduced aspects of technology to peers. As leaders they were sensitive to the needs of others and often waited until a teacher showed interest before sharing their expertise. Choice was an important component of learning to use technology. They recognized the need for teachers to determine what they wanted to do. Novice teachers learning to use technology needed to experience the feeling of ownership.

> I do some sharing with people in my department. I have shown people what I am using in my classroom as well as various sites on the Internet such as Track Star. I made some presentations to the building, in service training, and there I am being responsible for that sort of thing. A lot of people who go to those things have absolutely no interest in using technology in their classrooms. They are being forced to listen to something they don't want to listen to because it is required. What I would rather do is have an informal training and say this is what I am going to be doing and if you are interested, come by. It makes the time better spent for everyone involved. Some of the newer teachers are interested in using the technology. They like to see what is coming out. That is one advantage of being at the Professional Learning Center. They keep you on top of what's new and expose you to it. It gives me the exposure and then I can come back and share it. (Mr. Rogers, January 2001)

> I offer monthly technology training after school. The staff requests what they want. Some activities are very basic such as how to use Elmo. I am open to sharing with teachers anytime. If I find something helpful such as a web site I will share it. (Ms. Long, December 2000)

Ms. Maple and Ms. Martin believed technology fostered opportunities for collaborative learning and interdisciplinary projects.

> I try to do cross-curriculum projects. Technology has helped us cross boundaries. Technology is the common thread. I teach how to do research online and you teach them how to write. That way teaching students how to write is not one more thing they have to try and work in. (Ms. Maple, January 2001)

Ms. Martin, a language arts teacher, collaborated with a foreign language teacher. They had students design a travel brochure as one way of introducing technology into the

foreign language curriculum. While searching for information, students were transported to many different countries.

> I worked with one teacher at the first. I helped her do one of the projects I did. It is usually a matter of getting someone interested and then having them ask for help. A foreign language teacher asked if I would help her do a brochure as a project. We put a template together. Then I showed her how to use the template to get her comfortable. (Ms. Martin, December 2000)

All of the participants shared their technology expertise with other teachers. Informal sharing included troubleshooting when other teachers had problems with equipment or software. All teachers said they shared information they found on web sites with others in their departments. The role of technology leader extended to students for nine of the teachers interviewed. They modeled how to teach with technology and then had students take part in the teaching.

Formal sharing meant planned activities either on-site, within the school district, or at the state or national level. All teachers but one reported facilitating a site workshop involving technology. Seven of the ten participants were designated as site coordinators, members of technology committees, or peer mentors. Seven teachers said they presented workshops beyond the district level. Four participants taught technology classes at community colleges or technical schools.

Ms. Young was the only participant who had not conducted technology training. When asked if she shared her technology expertise, Ms. Young indicated there was a lot of sharing among the teachers and replied, "If they have a question, they ask me." The help she spoke of pertained to task management, not curriculum. She helped teachers save grades to the server.

Teachers who used technology to teach were natural facilitators. Their commitment to learning and their responsibility to teach others how to use technology

encouraged them to seek opportunities for sharing their technology-learning with others. Being receptive to change, they sought others who would appreciate the opportunity to learn new ways of teaching. Because teachers looked for opportunities that fostered collegiality, they derived pleasure in helping other teachers gain confidence with technology. As leaders took on the task of empowering others, they strengthened their own knowledge.

Summary of Teachers Integrating Technology

The 12 teacher participants in my study valued technology. All believed themselves to be proficient in technology and spoke of having a high level of comfort when using technology. They all said they assisted fellow teachers when they experienced problems using technology. Every teacher had a commitment to learning and preferred practical staff development. Their commitment to learning motivated all teachers to make changes in the method of preparing material presented to students. The 12 teacher participants valued collegial opportunities to exchange ideas. The difference was reflected in how they viewed their roles as teachers and the methods they used to teach.

Only ten of the 12 teacher participants integrated technology into teaching. Teachers who used technology in their face-to-face teaching envisioned their roles as a teacher extending beyond the mere teaching of subject matter. In their roles as teachers they felt a responsibility to teach their subject matter as it related to life beyond the classroom. They made their subject matter relevant to the students. Believing technology would be a prominent force in the lives of their students, they made the effort to use it. Because students were exposed to technology outside of the classroom, they chose to integrate technology in the classroom.

Face-to-face teaching with technology changed the way teachers taught. Teachers using technology took advantage of the many educational sites available. They shared the task of delivering information to students with other qualified experts from various fields of study. They transcended the boundaries of the classroom to bring real- world educational experiences to their students. Students were given the opportunity to choose topics and present information to the class. The method of teacher-directed lectures and individual projects gave way to the method of the teacher as facilitator of information and group work. There was a heightened sense of students being able to explore and exchange information with other students.

Summary

Teacher technology training at the Professional Learning Center is designed to build on the basic computer knowledge teachers have and models various ways for teachers to use technology for effective, innovative teaching. By observing demonstrations by teacher trainers and participating in hands-on activities, teachers designed lessons using the Internet, Track Star, web pages, and PowerPoint. Mentors supported teachers as they practiced during teacher technology training and were available by email after teachers returned to their respective schools. Additional training was offered on a variety of topics for those who successfully completed the training.

Teachers who learned to integrate technology in their teaching shared common beliefs. Their commitment to learning extended to fellow teachers and students. Many willingly devoted their time in the summer for staff development sessions that modeled innovative teaching methods. The teachers were receptive to change and continually modified their teaching. Believing they had a responsibility to prepare students to be life long learners, they searched for creative opportunities to use technology with students. By

sharing their technology expertise, teachers believed they would equip students with the technology skills needed in the workforce.

Teachers said staff development related to technology helped them improve their teaching. Eight teachers singled out teacher technology training as effective staff development for learning to use technology. The design of the training contained a majority of the components teachers said were needed for staff development training to improve teaching. The training provided time to practice and explore new learning, handouts in a notebook to reinforce learning, practical projects to use in the classroom, the ability to choose what teachers wanted to do, on-going workshops, and mentors to guide and support learning. Teachers credited teacher technology training for expanding their comfort level with technology.

When teachers integrated technology in teaching, changes in teaching took place in varying degrees depending on how technology was used. For some, learning transcended the boundaries of the classroom by transporting students to places they had never experienced. Students visited laboratories where scientists conducted experiments. They witnessed ruins of war. Technology enabled teachers to share the task of imparting information. Teachers shared the role of teacher with experts in the field, their students, and other teachers. Lessons, tests, and projects were easily modified. Technology deepened understanding by providing materials, supplements, and experiences that brought subject matter to life. Technology captured the interest of students. It fostered opportunities for creativity and collegiality.

Teachers took the needs of their students into consideration as they constructed their methods of teaching. Students had a choice in the topics they studied. They learned subject matter and technology skills when they presented information. Lecture notes and

review materials were accessible to students. There was a sense of freedom in the classroom as teachers moved about facilitating learning and showed interest in their students.

Teachers who used technology in their teaching exhibited characteristics of leadership. Their commitment to learning and appreciation for collegiality encouraged them to mentor teachers who were willing to explore the possibilities technology had to offer. Teachers took on the role of leader because they believed technology was an important tool for innovative teaching and learning.

CHAPTER V

SUMMARY, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Summary

This qualitative study was designed to explore the impact of staff development training on technology integration for secondary teachers. Believing that traditional staff development for technology integration was not successful, I chose to explore a staff development design incorporated by the Professional Learning Center to determine if the design would encourage technology integration. The study also considered the possibility that teachers who completed the training might be leaders for technology integration among their peers.

This study proposed that traditional staff development will not result in equipping teachers with the technology skills and pedagogy necessary for preparing students to be productive citizens in a global economy. It also proposed the need for teachers to be leaders in technology integration: (1) as a means of providing on-going support for technology integration, (2) acting as role models for best practice, and (3) developing new skills for innovative teaching. Teachers who took a leadership role should have realized self-satisfaction as a result of working in collaborative relationships with their peers.

Chapter I presented the introduction and background of the study. It expressed the need for educators to be an integral part of educational reform by providing staff development opportunities that encouraged teachers to integrate the technology already placed in the classroom. This study required a reflective look at staff development for

technology integration to determine if technology was used as a part of the daily classroom activities to support the curriculum and engage students in meaningful learning.

Chapter II provided an in-depth review of the literature related to the use of technology in schools. The literature addressed factors believed to be instrumental in staff development for technology integration. The four areas of focus were: (1) technology in schools, (2) views on learning, (3) dynamics of staff development, and (4) teachers as leaders for technology integration.

Technology in schools

A review of the literature on the role of technology in schools revealed that educators have succeeded in placing technology in the classrooms but teachers have not integrated technology into their teaching practices. Historically, schools purchased technology and offered staff development in how to use the computer for tasks such as word processing. Little instruction was given on how to use technology in teaching. Despite the influx of hardware and Internet access, technology was not an integral part of the classroom.

Internet access in schools provided many extraordinary sources of information that could be useful in the classroom if teachers would incorporate them into their teaching. The Internet gave teachers access to experts in the field and to educational sites that provided for greater understanding through visual representation.

A review of the literature related to technology integration stressed the need for a change in the learning environment. The teaching profession had not addressed the changes needed for teaching in an environment where students needed to be able to sift through an abundance of information and discern what was relevant. Literature indicated that integrating technology into teaching practices was essential in preparing students for the twenty-first century.

Views on learning

A review of the literature on learning suggested the need for new ways to process knowledge. The influx of information has resulted in the necessity for students to apply the techniques of discovery and evaluating knowledge in learning rather than spend time memorizing facts. Research on technology related to learning revealed that learning needed to focus on the student's ability to understand knowledge in terms of ideas and issues and then apply that knowledge in different contexts.

Literature suggested teachers needed to make changes if they were going to move toward technology integration. Technology called for a change in how teachers perceived their roles in the classroom. The changes included: (1) interactivity with teachers, other students, and experts in various fields of study, (2) self-initiated learning or discovery learning in which the students explored areas of interest, (3) teachers acting as coaches or facilitators, and (4) a learning environment that extended beyond the classroom.

Literature on teachers as adult learners revealed that staff development training for teachers needed to consider how adults learned. Teachers wanted to be in control of what they learned for learning to be meaningful. Prior experiences affected learning. Reflective practice was beneficial because it helped discover new ways to solve old problems.

Literature on learning related to technology in education discussed effective learning environments. Technology contributed to the learning environment in the following ways: (1) bringing real-world problems into classrooms, (2) granting greater flexibility for transferring knowledge to other areas, (3) increasing opportunities for feedback, and (4) building local and global communities.

Dynamics of staff development

Staff development was defined by Glickman and others (1995) as learning opportunities legally sanctioned and supported by the school system. Literature related to traditional staff development for technology indicated that the traditional staff development model focused on one-time experiences and gave little thought of expanding the teacher's knowledge of best practice. Staff development training did not demonstrate how to use technology for innovative teaching. It did not address the role of the teacher or how technology could extend learning.

A review of the literature for technology integration suggested the need for a different staff development design. Teachers should be placed in an active role, they needed demonstrations to see how innovative teaching occurred, and teachers desired extended time for learning and practicing. Teachers desired opportunities to choose activities and the ability to develop materials they could use in the classroom. Suggested staff development for technology integration needed to be on-going and include peer observations, collaboration, mentors, ability to give feedback, and opportunities for further development. Interviews with teacher participants reinforced the importance of teachers being able to choose staff development activities that provided hands-on training. Other kinds of staff development activities were regarded as a "waste of time."

Teachers as leaders

The literature review on leadership among teachers who integrated technology indicated teachers who used technology tended to share their expertise with other teachers. They looked for opportunities to mesh the attributes of technology with the teaching practices of the individual teacher. The endless possibilities for innovative teaching with technology called for teachers who were proficient in technology to mentor other teachers.

Collaboration is a must if teachers are going to keep up with the rapidly changing technological advances. Using teachers to train and mentor other teachers appeared to be an effective method of keeping up with the vast changes. Mentoring proved advantageous for everyone. Teachers who were mentored became more proficient in technology and teachers who served as mentors validated their skills. Interviews with teacher participants supported the findings in the literature review. Teachers who learned technology skills from technology trainers improved their search strategies, web pages, knowledge of programs, and raised their level of comfort with technology. Teacher participants who later became technology trainers said they always learned something new themselves when they taught others how to use technology.

Chapter III presented the methodology for the study. The qualitative approach to research was addressed as well as how participants were chosen, the reason for using the survey, information about the interview process, the methods of analysis, and efforts used to ensure reliability, validity, and generalizability of the study. The major research questions were: (1) If teachers complete the teacher technology training staff development at the Professional Learning Center, will they integrate technology in their teaching? and (2) If teachers complete the teacher technology training staff development, will they move to the stage of Teacher as Leader?

After an analysis of data, the focus of the research questions shifted to the following questions:

(1) What are the beliefs of teachers who use technology?

(2) What do teachers who use technology value in staff development?

(3) How does the use of technology change teaching?

Chapter IV provided a presentation and analysis of data gathered by the researcher. Analysis focused on the following questions:

1. Does the participants' notion of staff development that contributes to teacher improvement match the design of teacher technology training?
2. Does the staff development design of teacher technology training at the Professional Learning Center affect technology integration?
3. How does technology integration change teaching?
4. Does the staff development design for technology integration contribute to teachers being leaders in technology integration?

In response to Question 1, teacher technology training matched the participants' notions of staff development that contributed to teacher improvement. They valued the collaborative opportunities, mentoring, demonstrations followed by hands-on learning, time to play and experiment, and the time devoted to creating projects they chose that could be used immediately in their classrooms. Teachers said the training had a significant impact on their level of comfort using computers.

In response to Question 2, all 12 of the teacher participants made use of the skills they learned while attending teacher technology training and improved their teaching by using technology to research information they presented to students. Ten of the teachers said they integrated the skills they learned into their face-to-face teaching with students. Eleven of the 12 participants said technology improved their teaching. Their experience with the training introduced them to credible Internet sites for researching and taught them where to gather lesson plans. The training assisted them in designing their own web page, taught or perfected their skills in PowerPoint for multimedia presentations, and introduced them to virtual tours to enhance learning.

In response to Question 3, the ten teachers that integrated technology into their face-to-face teaching with students said technology changed their teaching. PowerPoint was used to make announcements and give tests rather than writing on the board, preparing transparencies, or duplicating questions on paper. Teachers remarked that it saved time and allowed for test questions to be changed for each class. Subject matter was important to the teachers but taught in the context of real-world experiences. Teachers were not the center of focus and students were not limited to learning in an isolated classroom. Teachers shared the presentation of information with other people. Technology helped students visualize concepts and made learning more interesting. The abundance of information available through technology encouraged students to discover information and engage in problem-solving rather than memorize facts.

In response to Question 4, the design for technology integration incorporated in teacher technology training contributed to teachers being leaders. All of the teachers said their comfort level with technology increased. Their confidence with technology encouraged them to troubleshoot problems other teachers encountered with technology. They all shared sites they discovered on the Internet with peers. Eleven of the 12 teachers conducted staff development training either for their building or at their site. Seven of the ten were designated as site coordinators, members of technology committees, or peer mentors; and presented workshops beyond the district level. Four teachers had taken or were in the process of taking the training to be teacher trainers. Four participants taught technology classes at community colleges or technical schools.

The following section presents the conclusions developed from the data, the implications for technology integration, and recommendations for future research.

Conclusions

Conclusions to be discussed from the study are: (1) the importance of an appropriate staff development design to encourage technology integration, (2) the effect of the teacher's perceptions of teaching on the use of technology, (3) the necessity for teachers to change from controlling the information to facilitating the discovery of information, (4) the importance of teachers being leaders in technology integration, and (5) the role of Rogers' (1995) *Diffusion of Innovations* and Sherry's (1997*) Integrated Technology Adoption and Diffusion Model* in deciding to integrate technology.

Teaching with technology begins with providing appropriate staff development because teachers cannot begin to make the necessary changes in teaching if they do not know what to do. The issue is not as simple as whether or not a teacher uses technology. A decade ago, McKenzie (1991) cautioned:

> In order to lead students out of the Industrial age and into the Information Age, teachers must be prepared to adapt and adjust to the many changes that will occur as this century comes to a close. If teachers are to shed their time-honored role as transmitters of the present culture and assume the role of continuous learners, staff development practices must shift radically during the next decade. (p. 3)

Technology integration has a foundation that is firmly rooted in basic technology skills coupled with teachers' beliefs that encourage the use of technology. As teachers acquire the basic computer skills, they move on to more sophisticated applications. Word processing skills may develop into PowerPoint and multimedia presentations. Email enables participation in listservs. Internet searching may lead to innovative lesson plans, video conferencing and virtual tours. Figure 5.1, Growth for Technology Integration, demonstrates the possibilities for teaching when skills are merged with teachers' beliefs.

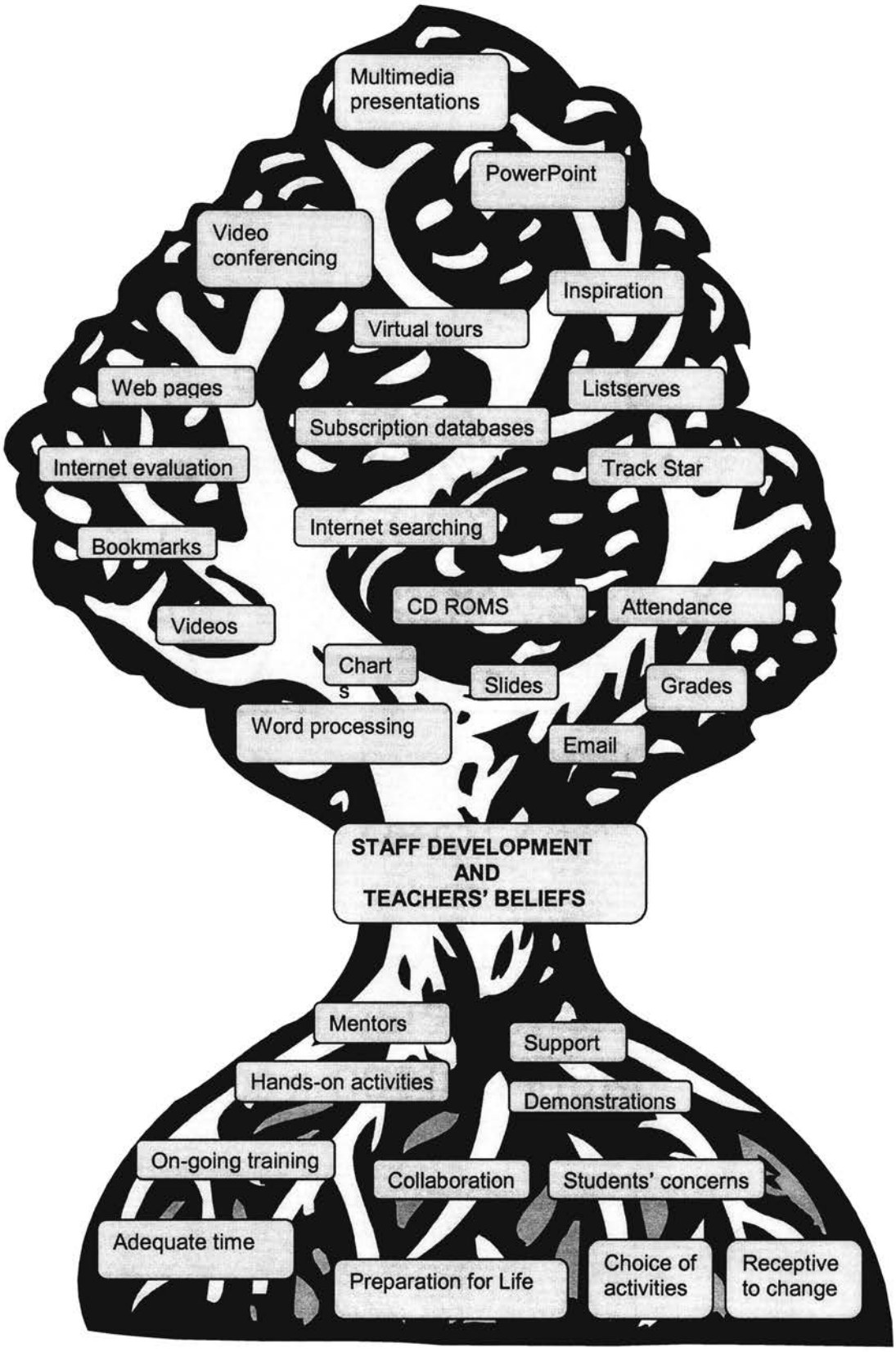

Figure 5.1. Growth for Technology Integration

Appropriate staff development for technology integration

Bray (1999) cautions educators to consider the needs of teachers if teachers are expected to use technology as a dynamic part of the curriculum. Teacher participants said staff development to improve teaching needed to include: (1) sufficient time to learn and practice, (2) opportunities to collaborate with other teachers, (3) practical, hands-on experiences, and (4) support for on-going training and mentoring.

Teachers did not have time to experiment with technology during the school day. They wanted to attend staff development when they could focus on learning. If staff development was scheduled after school, they were tired and preoccupied with the demands of the classroom. Sufficient time to practice increased their level of comfort with technology. Even though many teachers spoke of having some knowledge of PowerPoint and Internet searching, teacher technology training gave them the time to further develop their skills and create projects.

Teachers appreciated time for collaboration during staff development because it sparked their enthusiasm. Teachers believed facilitators with classroom experience were more credible. They learned more from teacher trainers who exhibited technology expertise as well as an understanding of the curriculum and teaching than from presenters proficient in technology alone.

Practical, hands-on experiences reinforced skills and encouraged creativity in teachers. Hand-outs reinforced what was learned. Teachers specifically appreciated the notebook used during teacher technology training with directions for creating projects and room to take notes. Hands-on experiences at the teacher technology training were particularly helpful. Technicians made sure the equipment worked so trainers and students could concentrate on skills and products.

Teachers credited the Professional Learning Center with creating an environment conducive to learning. They had teachers to support them while they learned as well as email addresses to reach teacher trainers and fellow participants after the training. Some participants spoke of being reluctant to ask teachers in their building for help. They preferred to email teacher trainers or other participants from their training session. Teacher technology training qualified participants to participate in additional training opportunities. Many of the participants took advantage of additional sessions and mentioned other sessions they planned to attend.

Teachers' perceptions of teaching

Teachers who believed their role was primarily to teach subject matter were not using technology in their face-to-face teaching with students. Technology was used to enhance the information they presented to students. Teachers who integrated technology taught their subject matter in relation to real-world problems. They desired to equip students with skills they would need in the workforce. All of the educational learning centered on real-world experiences thus preparing students to be lifelong learners.

Controlling information to facilitating the discovery of information

Teachers who integrated technology in their classrooms changed from being the focus of knowledge to facilitating the discovery of knowledge. They allowed students to discover their own knowledge. As facilitators, teachers took advantage of sites on the Internet that succeeded in transporting students beyond the confines of the classroom. They supplied students with visual opportunities to make learning more meaningful. They enabled students to learn from the most current sources available. They had opportunities to listen to experts in various fields of study.

Teachers being leaders

The concept of teachers as leaders is important to technology integration. Teachers who insist on working in isolation will have a difficult time adjusting to the role of facilitator. Participants spoke of their excitement when other teachers used technology successfully. They believed technology was an important part of a student's education and looked for ways to assist teachers in using technology for teaching. Because technology changes so rapidly, keeping up with educational software and hardware requires a collaborative effort. Teacher leaders who use technology for innovative teaching will lend credibility to technology integration and encourage others to follow their lead.

Lack of effective staff development is a significant barrier to the effective use of technology, and the amount of technology available to teachers affects the way it is used in the classroom (Norman, 1999). Schools must support the technology needs of the teachers. If schools are to prepare students for life, technology has to be a part of their experience in school. Teachers must change their notion of being the sole presenter of information and become a facilitator as students explore and collaborate to solve problems. No teacher can possibly have all the knowledge. Students cannot be expected to know all the answers. Teachers must use their knowledge to guide students in obtaining, organizing, synthesizing and managing information.

An Integrated Technology Adoption and Diffusion Model

Sherry and her colleagues (2000) said their teachers who had reaffirmed the use of technology assisted colleagues with troubleshooting equipment, gave in-service sessions, served on technology committees, and became peer trainers. Participants in the study mentioned they were involved in the same kinds of activities in their respective schools.

Ms. Young and Ms. Elder were the two teachers who did not embrace technology as a worthwhile tool for face-to-face teaching. Looking at Rogers' first three characteristics of innovations; relative advantage, compatibility, and complexity, it is easy to explain why the two teachers did not integrate technology. They held on to their notion of the teacher being the main presenter of information and saw no advantage to teaching differently. Using technology to teach was not compatible with their existing values, past experiences, or needs. Using technology to teach was seen as too complex. Both Ms. Elder and Ms. Young alluded to the fact that they would like to use technology but had not taken steps to move in that direction.

The characteristics of trialability and observability may be a reflection of the lack of support shown by administration for integrating technology. Teachers have to be able to experiment with technology. Ms. Elder indicated she was unable to get the equipment necessary for projecting the Internet to her students. Both Ms. Elder and Ms. Young said it was hard to book the computer lab for classes. If administrators gave teachers time for collaboration and mentoring, the innovation of technology integration could be observed and discussed and perhaps adopted by more teachers.

Implications

Implications that relate to technology integration are: (1) teachers can no longer isolate themselves in their classrooms and expect to meet the educational needs of students in the Information Age, (2) good staff development is essential for technology integration, (3) districts must support and maintain technology for technology to be integrated by the teachers, (4) time needs to be allotted for collaboration, and (5) principal evaluation of

teachers may need to include the use of technology in teaching if administrators expect technology to have a significant role in the classroom.

Learning environments appropriate for the twenty-first century include collaboration and discovery learning. The notion of the teacher teaching in an isolated classroom is out-dated. No one person can deliver all the knowledge. Learning requires a joint effort between those who have the expertise in the subject area and teachers who guide the learning. Collaborative projects prepare students for the workforce. They teach students to share in the gathering of information, synthesize the information, and then apply it to other areas. Interviews with teachers stressed the importance of sharing the delivery of information with experts in the field. The teachers believed students learned by presenting information themselves. When students chose topics they wished to explore, they became more responsible for their own learning.

Good staff development is essential for technology integration. Teachers interviewed said the training they had in teacher technology training enabled them to turn basic computer skills into web pages to communicate with parents and students, find lessons to enhance their teaching, and locate resources to help them teach. Teachers said staff development that did not include hands-on activities to develop lessons to use in teaching was a waste of their time.

Districts must support teachers with hardware that will enable teachers to integrate technology. Technicians need to be available to keep teachers from being discouraged when things will not work properly. Presentation systems need to be available so students may observe Internet sites that strengthen understanding under the guidance of the teacher. One computer with Internet access and a method to show relevant educational sites from

the Internet will do more for education than one computer per student. Educators need to measure quality not quantity.

Time was a major factor when teachers discussed using technology. Teachers spent many hours outside of the school day perfecting technology skills. Teachers who used technology in the classroom indicated on the survey that they should be given formal training and extra pay if they were expected to learn new technologies. In the survey, most of the participants said they preferred to learn new programs and approaches with a partner. Formal training may not be feasible, but since teachers said they valued collaboration in the interviews, giving teachers time to collaborate would be one place to start. Once staff development is over, teachers need time to collaborate and reflect with other teachers to determine best practice and continue to develop their skills. On-going staff development maximizes the potential of the teacher.

If districts have the expectation of technology being integrated into teaching, principal evaluations of teachers may need to include a component on technology use in teaching. Evaluations can be subjective. Being able to document innovative teaching with technology would provide objective information for evaluating performance.

Once technology becomes a part of teaching, there are other implications to consider. Those implications include: (1) making sure the use of technology is grounded in good lesson plans that are aligned with curriculum goals set by the school district and the state, (2) implementing appropriate assessment of the use of technology, and (3) realizing the limitations of discovery learning.

Teacher participants indicated on the survey that although they believed it was important to be able to identify the connection between information literacy and

curriculum goals, they did not feel a high degree of proficiency. Teachers need to have a clear understanding of the curriculum goals and activities with technology need to support the curriculum. I believe it is important to strive toward equal educational opportunities for every student. If technology is not aligned with the curriculum goals, all students may not be learning what is expected at each grade level.

Implementing appropriate assessment is important in education. Educators seem to be implementing technology without assessing its worth in learning. Teachers who are reluctant to use technology may be encouraged by assessment that indicates technology improves learning. Reflecting back to Rogers' Diffusion model, showing teachers the advantage of teaching with technology may encourage them to adopt the innovation. Not assessing the technology in learning and teaching may be as detrimental as placing computers in classrooms without a plan for implementation. I strongly agree with Thornburg's comment that how teachers use technology is more important than if they use it (Levin & Dardin, 1999).

Discovery learning has some limitations. It encourages students to explore topics of interest and lends itself to researching on the Internet, but teachers need to work with students in evaluating what they find. One can locate a reliable site, and then in a matter of seconds, link to a site that is not reliable. If teachers do not teach students how to evaluate information they find, students may end up with information that is not credible. It is easy to get lost in the glitz. Students and teachers need to know how to evaluate sites for accuracy, authority, and timeliness. Oftentimes technology is not the best source of information. Students need to understand when to use online sources and when to use books in order to gather information that is both effective and efficient.

Along with any innovation comes responsibility. The wealth of information on the Internet makes it much easier to plagiarize someone else's work than to do one's own work. Capabilities of multimedia are vast. Students are used to fancy graphics and sounds. It is difficult to create an original presentation that is as good as one created commercially on the Internet. Easy access also results in lazy students. Gardiner (2001) cautions teachers to be aware of the many Internet sites that provide instant research papers to students. Teachers need to model ethical behavior as well as instruct students on ethical issues related to technology. They must instill a sense of creative worth in their students. Students need to have a pride in ownership and respect the works of others.

Integrating technology encompasses many skills. Teachers must have a clear understanding of the curriculum and how technology is able to extend the curriculum. They must have time to locate pertinent information and construct lessons that use technology. They should not be burdened with equipment that will not work, connections to the Internet that are not reliable, or incompatibilities of hardware and software.

Recommendations for Further Research

Based on the conclusions and implications of the study, there are six recommendations for further research on technology integration. They are:

1. Studies are needed to determine the educational value of using technology in the classroom. Students may find certain information more interesting or entertaining, but is the information they choose to learn pertinent to what students need to know and how well do they retain the information?

2. Research should explore the reasons why some teachers are not interested in using technology to enhance teaching. All teachers employed by school districts may apply for teacher technology training, yet many teachers do not take advantage of the opportunity to learn how to integrate technology.
3. More research needs to be conducted on the impact of technology integration on student learning. If teachers believed integrating technology could increase learning, would they be more willing to learn how to incorporate technology in their teaching?
4. Research is needed to determine if technology increases instances of plagiarism. If technology makes it so easy to use another's work, it may be stifling the creativity of students. Being more adept at plagiarism does not contribute to innovative teaching with technology.
5. Studies should examine the relationship between teachers' use of technology and teacher evaluation. If school districts believe teaching with technology is important in order to prepare students to be productive citizens and lifelong learners, then administrators may need to tie technology integration to teacher evaluation.
6. Research has addressed barriers to technology integration. Studies comparing technology integration in school districts with better than average technical support to districts with little technical support may be helpful in establishing the need for increased funding for additional technical support.

Reflection

Pursuing answers to questions is an on-going process in intellectual and personal growth. My interest in life-long learning encourages me to pursue different methods of learning so that learning can be a meaningful endeavor. I believe that if a person wants to

learn and participates in training applicable to the task, learning will occur. I expected good staff development to motivate all of the teachers to integrate technology who had participated in the teacher technology training. The teachers were interested in learning about technology and the staff development was meaningful. My belief that age did not make much difference in the use of technology proved correct. The oldest teacher participant and the youngest teacher participant were the ones not integrating technology into teaching.

I believed barriers to using technology would be inadequate equipment and lack of time to prepare to teach with technology. I found the main barrier to integrating technology to be the limits the teacher set in determining how teaching should be conducted. The notion of the teacher controlling the learning rather than facilitating kept two teachers from taking advantage of all technology had to offer. Ms. Young and Ms. Elder were reluctant to branch out and teach in a different manner.

Researching how teachers use technology in an effort to give teachers' voice resulted in the strengthening of my own voice. As a school library media specialist, I have spent the last 14 years helping faculty and students find the most appropriate information for their needs. That is what school library media specialists do. Just as teachers need to adjust their notions of teaching, media specialists are called to revisit their roles in the school's learning community.

The school library media specialist should be a vital part of any school's educational team. The American Association of School Librarians and Association for Educational Communications and Technology say we need to move away from supporting the teaching that prepared students for an industrial society and teach students to be learners in a society that will continuously generate new knowledge

(American..., 1998). Learners are defined as "people who inquire, who seek information, evaluate it, apply it to new problems, questions, or decisions, and assess how well the information has met their needs" (American...p. 131). School library media specialists need to make strides to see that learners are equipped to do just that.

School library media specialists occupy a rather tenuous place in the structure of the school. Many have skills to encourage technology integration in the classroom. They often serve as mentors to teachers and develop their own skills while working with others. Media specialists have insights to share with those determining best practice: (1) they observe many innovative teaching methods in their buildings, (2) they see how students react to various teaching styles, (3) they are aware of what students do with the information they gather, and (4) they have the resources to assist faculty and students. Unfortunately, many are not given the opportunity to make suggestions and implement strategies that will foster information literacy within the school's learning community. Without a peer group, they struggle to be heard. Administrators should listen to the insights gained by the media specialists who may view technology from a different perspective.

Summary

When teachers integrate technology, are they strengthening the curriculum or just providing educational entertainment? Even though the 12 participants in my study were proficient in many areas of technology integration, few believed they understood technology as it related to their curriculum. Technology will not enhance education if

teachers do not understand how to use it to complement instructional goals and reach all learning styles.

Educators need to know how to use technology in teaching to give students the advantage of all the educational information available. Exposing students to technology prepares students for the workforce and to be lifelong learners. It furnishes them with a greater variety of sources and enables them to experience knowledge not available through traditional teaching methods.

Innovative teaching methods demonstrated by staff development opportunities that incorporate a good design for technology integration help teachers prepare students to discover knowledge. As students gather and analyze information, they learn to transfer their problem-solving and critical thinking skills to other situations. Technology is just a tool. As with any teaching tool, technology needs to be subjected to authentic assessment to make sure students are receiving the kind of education necessary to equip them for the twenty-first century.

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APPENDIXES

APPENDIX A

The Technology in My Life Survey

Section A

Please mark each competency listed below to indicate how far you have progressed in meeting the competency. Then rate each competency for its importance (in your opinion) for teachers of this decade.

Degree of Proficiency Ratings H=High M=Medium L=Low		**Degree of Importance Ratings** H=High M=Medium L=Low
Proficiency	Importance	Competency
_____	_____	1. Finding my way around computers, using menus, windows, the mouse and basic functions with confidence.
_____	_____	2. Knowing how and when new technologies may enhance my classroom activities, support stronger student learning and help me meet curriculum standards.
_____	_____	3. Locating the learning opportunities I need to advance technology and literacy skills as new technologies arrive.
_____	_____	4. Identifying the connection between information literacy (making sense of information) and my curriculum goals.
_____	_____	5. Demonstrating how to use new technologies including networks, for problem-solving, research, communication, persuasion, presentation and decision-making.
_____	_____	6. Designing and developing (alone and with teammates) student learning activities that will integrate new technologies into the daily life of my classroom.
_____	_____	7. Showing skill in using productivity tools for professional and personal use, including word processing, database, spreadsheet and print-graphic utilities.
_____	_____	8. Demonstrating knowledge of equity, ethical, legal and human issues related to information literacy and new technologies.
_____	_____	9. Developing an expanded repertoire of strategies to promote student learning with different technologies including problem-based learning and student-centered inquiry.
_____	_____	10. Developing skill in showing students how to prospect, interpret and synthesize.

Section B

We are interested in knowing how you feel about learning new technologies and programs. Please indicate to what extent you agree or disagree with each of the following statements.

1. Most of the new technologies which have become available to me have been easy to learn with relatively little outside support and I am eager to get my hands on more equipment so I can teach myself more.
__strongly agree __agree __disagree __strongly disagree

2. Most of the technology that has been shown to me would do little to improve my ability to teach or my students' ability to learn and think.
__strongly agree __agree __disagree __strongly disagree

3. I have made enormous progress during the past year or so in learning new technologies to introduce them to my classroom.
__strongly agree __agree __disagree __strongly disagree __

4. People make far too big a deal over the management issues arising out of new technologies (scheduling, breakdowns, etc.).
__strongly agree __agree __disagree __strongly disagree

5. I have been able to integrate the use of new technologies so fully into my classroom that I am not sure what I would do if they took them away from me or cut off the electrical power.
__strongly agree __agree __disagree __strongly disagree

6. These new technologies have forced me to turn the classroom upside down and substantially change the way I teach or relate to the students.
__strongly agree __agree __disagree __strongly disagree

7. My biggest fear of these new technologies is embarrassment in front of my students or my colleagues.
__strongly agree __agree __disagree __strongly disagree

8. They cannot expect us to learn all these new technologies unless they give us much more formal training and extra pay.
__strongly agree __agree __disagree __strongly disagree

9. I prefer to learn new things as an individual.
__strongly agree __agree __disagree __strongly disagree

10. The best way to learn new technologies is to participate in formal training classes which show us just how to use the programs and how to integrate them into our classes.
__strongly agree __agree __disagree __strongly disagree

11. Sometimes I feel that there is just too much change coming too fast without enough planning or support for teachers. I wish they would just slow down.
__strongly agree __agree __disagree __strongly disagree

12. I have begun to enjoy teaching more than ever before because of the new power these technologies have put in the hands of my students and myself.
__strongly agree __agree __disagree __strongly disagree

13. I do best with new programs and approaches when I can learn them with a partner.
__strongly agree __agree __disagree __strongly disagree

14. All this new equipment and technology is basically one more bandwagon in a long chain of innovations which have made little impact on my classroom or my students.
__strongly agree __agree __disagree __strongly disagree

15. Even though I have more to learn, I am really proud of what I have accomplished with new technologies and I am ready to share my inventions with colleagues both here in the district and at professional meetings or conventions.
__strongly agree __agree __disagree __strongly disagree

16. I sometime feel that I have been left behind when it comes to technology. I don't feel comfortable with it and I don't see what good it will do.
__strongly agree __agree __disagree __strongly disagree

17. I enjoy working with teams of colleagues building unit and lesson plans that translate these new tools into something I can actually use in my classroom.
__strongly agree __agree __disagree __strongly disagree

18. I am disturbed by the disorganization, lack of reliability and pop culture so typical of much of the information coming over the free Internet.
__strongly agree __agree __disagree __strongly disagree

19. I have come to value books, libraries and librarians more and more as I have explored new information sources.
__strongly agree __agree __disagree __strongly disagree

20. I feel well prepared to take on any and all new challenges related to new technologies.
__strongly agree __agree __disagree __strongly disagree

Section C: Rate your feelings of proficiency
H=High
M=Medium
L=Low

___ Searching for information with electronic periodicals or Internet search engines.

___ Using electronic mail or listservs to communicate and learn

___ Employing electronic tools such as attendance or marking programs

___ Communicating ideas with desktop publishing programs

___ Communicating ideas with presentation programs such as PowerPoint or Persuasion

___ Searching for information with CD-ROM's

___ Applying Boolean logic to searches to target pertinent information

___ Expressing ideas with word-processing

___ Using databases together with spreadsheets to collect and analyze curriculum related issues

___ Creating charts from data to interpret and communicate findings

___ Modifying images with graphics programs to help communicate ideas

___ Employing computer simulations as a way of exploring curriculum issues and concepts.

APPENDIX B

Response to inquiry concerning use of survey

Date: Wed, 8 Mar 2000 18:56:08 -0800

To: Barbara Ray <bdrayusa@netscape.net>

From: Jamie McKenzie <fromnowon@earthlink.net

Subject: Re: surveys

That would be great. Do you have the most recent version?

Will you share findings?

Jamie McKenzie

Editor - "From Now On - The Educational Technology Journal"

fromnowon@earthlink.net http://fno.org

500 Fifteenth Street http://staffdevelop.org

Bellingham, WA 98225 http://questioning.org

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APPENDIX C

Interview Questions

1. Reflect on your role as a teacher. What factors helped you improve as a teacher the most?

2. Reflect on the various staff development activities in which you have participated. What helped you become a better teacher? What was a waste of your time?

3. I would like you to reflect on technology. What kinds of experiences expanded your knowledge and comfort level using technology? What have you done that did not work to increase your use of technology?

4. Reflect on your experiences with [teacher technology training]. What helped you increase your technology skills? What did not help?

5. Tell me how you use technology in your day-to-day teaching?

6. How has technology changed your teaching?

7. Could you give me some examples of how you share your technology expertise with other teachers?

APPENDIX D

Consent form for teachers

I, _____, hereby authorize Barbara Ray to interview me, administer a survey, and possibly conduct a classroom observation. I understand the following to be true:

- A taped, transcribed interview lasting approximately one hour will be conducted by Mrs. Ray in my classroom or another suitable room at my school. The interview is for the express purpose of asking my opinions on teaching, staff development, and the use of technology.

- I may be observed in my classroom and participate in a follow up interview. All interviews and observations will be completed by February 2001.

- Aliases will be used so at no time will my identity be known.

- Interviews will be voluntary. I may withdraw from the study at any time.

- Tapes will be kept under lock and key while at school and taken home at the end of the day. Tapes will be erased after they have been transcribed.

The purpose of my research is to determine what teachers are doing in their classrooms after they have participated in staff development activities to encourage technology integration. The data will be used in my dissertation topic on the affects of staff development in the use of technology in the classroom. Data will be gathered through a survey, interview, and an observation.

I, _____, have read and fully understand the consent form. I sign it freely and voluntarily. I understand I may contact Dr. Martin Burlingame at (405) 744-9196. I may also contact Sharon Bacher, IRB Executive Secretary, Oklahoma State University, 203 Whitehurst, Stillwater, OK 74078; telephone number: (405) 744-5700.

A copy has been given to me.

Date:_____ Participant:_____

I certify that I have personally explained all elements of this form to the subject or his/her

representative before requesting the consent form be signed.

Date:_____ Researcher:_____

APPENDIX E

Consent form for principals

I, _____, hereby authorize Barbara Ray to conduct a classroom observation with one or more of my teachers. I understand the following to be true:

- A taped, transcribed interview will be conducted by Mrs. Ray for the express purpose of asking teachers their opinions on teaching, staff development, and the use of technology.
- Aliases will be used so at no time will their identity be known or the identity of the school.
- The teacher may withdraw from the study at any time.
- Tapes will be kept under lock and key while at school and taken home at the end of the day. Tapes will be erased after they have been transcribed.

The purpose of my research is to determine what teachers are doing in their classrooms after they have participated in staff development activities to encourage technology integration. The data will be used in my dissertation topic on the affects of staff development in the use of technology in the classroom. Data will be gathered through a survey, interview, and an observation.

I, _____, have read and fully understand the consent form. I sign it freely and voluntarily. I understand I may contact Dr. Martin Burlingame at (405) 744-9196. I may also contact Sharon Bacher, IRB Executive Secretary, Oklahoma State University, 203 Whitehurst, Stillwater, OK 74078; telephone number: (405) 744-5700.

A copy has been given to me.

Date:_____ Principal:_____

I certify that I have personally explained all elements of this form to the subject or his/her representative before requesting the consent form be signed.

Date:_____ Researcher:_____

APPENDIX F

Level One Skills: Teacher Technology Training

In order for teachers to participate in teacher technology training, they must be competent in the following Level One skills as determined by the state:

Turn on and shut down computer properly.
Use the find utility to locate folders and files on the computer.
Use the control panel to change system settings.
Perform file management on the desktop including organizing files, folders, etc
Resize windows on the desktop.
Maintain your system creating backups onto storage media.
Rename a file or shortcut.
Start and exit out of a program.
Open an existing document.
Work within a document using copy, move, delete, save and other editing commands
Get help using on-line help menus within a program
Use keyboard shortcuts.
Print documents and other files within an application.
Demonstrate basic skills necessary to use a word processor.
Demonstrate basic skills necessary to use a spreadsheet.
Demonstrate basic skills necessary to use a database.
Develop a presentation using presentation software & importing clip art, & pictures
Establish and Internet connection.
Use and Internet browser.
Search for resources on-line using a search engine.
Send and receive e-mail.
Identify and use proper netiquette.
Have equipment and connectivity for practice and use.

APPENDIX G

Member Check Letter

May 23, 2001

Dear_____;

I want to take this opportunity to thank you for sharing your opinions on how teachers improve, the kinds of staff development you find effective, and your experiences with [teacher technology training at the [Professional Learning Center]. I appreciated your willingness to be interviewed.

As I continue to sort through all the comments, I want to be sure I have conveyed your comments accurately. Please review the attached transcript of our interview together. If you believe I need to clarify any point, please call or email me with changes. I may be reached at home at _____ or through email at _____.

I hope my research will inform technology staff development activities. It was a pleasure meeting you and sharing ideas about staff development.

Sincerely,

APPENDIX H

Oklahoma State University
Institutional Review Board

Protocol Expires: 12/3/2001

Date : Monday, December 04, 2000 IRB Application No ED0153

Proposal Title: RELATIONSHIP BETWEEN STAFF DEVELOPMENT AND THE USE OF TECHNOLOGY BY TWELVE SECONDARY LANGUAGE ARTS AND SCIENCE TEACHERS

Principal Investigator(s) :

Barbara Ray
315 Willard
Stillwater, OK 74078

Martin Burlingame
203 Willard
Stillwater, OK 74078

Reviewed and Processed as: Expedited

Approval Status Recommended by Reviewer(s) : Approved

Signature : Carol Olson

Carol Olson, Director of University Research Compliance

Monday, December 04, 2000
Date

Approvals are valid for one calendar year, after which time a request for continuation must be submitted. Any modifications to the research project approved by the IRB must be submitted for approval with the advisor's signature. The IRB office MUST be notified in writing when a project is complete. Approved projects are subject to monitoring by the IRB. Expedited and exempt projects may be reviewed by the full Institutional Review Board.

VITA

Barbara Jo Ray

Candidate for the Degree of

Doctor of Education

Thesis: IMPACT OF STAFF DEVELOPMENT TRAINING ON TECHNOLOGY INTEGRATION IN SECONDARY SCHOOL TEACHERS' CLASSROOMS

Major Field: Higher Education

Education: Graduated from Northwest Classen High School, Oklahoma City, Oklahoma in May, 1964; received Bachelor of Arts degree in Sociology from Oklahoma State University in May 1968; received Masters in Library and Information Studies from University of Oklahoma in May 1986. Completed the requirements for the Doctor of Education degree with a major in Higher Education at Oklahoma State University in December 2001.

Experience: Began my career as a school library media specialist at West Elementary School in Jenks, Oklahoma from 1986 to 1987; employed in Broken Arrow, Oklahoma as a school library media specialist at Central Middle School from 1988 to 1991; employed in Jenks, Oklahoma as a school library media specialist from 1992 to 2001; employed by Northeastern State University as an assistant professor of Library Media and Information Technology from August 2001 to present.

Professional Memberships: American Association of School Librarians, American Association of University Professors, American Library Association, Association for Supervision and Curriculum Development, Beta Phi Mu, Kappa Delta Pi, Oklahoma Library Association, Oklahoma Association for School Library Media Specialists, Phi Delta Kappa