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A Multimethodological Study of Teachers' Perceptions of Technology Professional Development

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A MULTIMETHODOLOGICAL STUDY OF TEACHERS' PERCEPTIONS OF TECHNOLOGY PROFESSIONAL DEVELOPMENT

by

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CHAPTER I

INTRODUCTION

Statement of the Problem

The integration of computers into educational environments has been an ongoing process for over two decades. Aggressive plans to introduce technology into schools were championed by President Clinton in his 1996 State of the Union address. During this address to the nation, President Clinton challenged both Congress and the American people to deliver high-speed Internet access and high-quality technology into the hands of students.

> Our . . . challenge is to provide Americans with the educational opportunities we'll all need for [the 21st] century. In our schools, every classroom in America must be connected to the information superhighway with computers and good software and well-trained teachers. We are working with the telecommunications industry, educators, and parents to connect . . . every classroom and every library in the entire United States by the year 2000. I ask Congress to support this educational technology initiative so that we can make sure this national partnership succeeds.

In order to achieve this goal, several models for technology implementation were proposed, with costs ranging from 8 to 20 billion dollars. This estimate tripled the expenditure schools were investing at the time, yet remained less than 4% of the total school budget (Office of Educational Technology [OET], 1997). In this report, it was estimated that the cost of technology implementation for schools could range

from $600–$1,000 per student. Yet this often does not account for the cost of technology professional development which is vital to its success.

In the 1980s, the flood of technology began to see its way into classrooms with the proposed capability of creating engaging and interactive environments. By the 1990s, technology was viewed as an indispensable tool (Hope, 1997a). The perception that technology can have a positive and transformative impact on the teaching environment has long been appreciated (Disessa, 1987) and there is support in the literature which holds that the thoughtful integration of technology can transform the teaching environment (Renyi, 1998). To achieve this integration, technology professional development continues to be a vital support mechanism for sustained change.

Technology professional development has been at the forefront of conversation since computer technology began to move into schools in the 1980s. It must be designed to provide sustained change in classrooms. Professional development for educators has been defined as a process to focus on the knowledge, skills, and attitudes of teachers in order to positively affect student learning (Sparks & Richardson, 1997). Professional development for educators should further provide for "general professional growth, refinement of existing skills, and acquisition of new skills to meet changing needs" (Cannon, 1981). Even though it is considered a vital component of successful technology integration in schools, technology professional development remains under-funded, under-utilized, under-developed, and largely under-evaluated. The Office of Technology Assessment (OTA, 1995) reported that

the baseline for funding technology professional development should be approximately 30% of the technology budget. Research has indicated that most schools provide less than 15% of their budget for technology professional development. The use of technology in classrooms can change the way teachers teach, but it is unrealistic to believe that substantive integration can take place simply by placing computers into the classroom (Schofield, 1995).

The integration of computers into the educational environment requires planning that must include a substantial professional development plan (Cooley, 1998). School administrators must ensure that a comprehensive professional development program exists to support teachers in their understanding of how to use computers to support instruction.

There is evidence that exceptional technology professional development practices can ensure success for teachers (Browne & Ritchie, 1991; Buchsbaum, 1992; Cooley, 1998; Guskey, 1986; Hadley & Sheingold, 1993; Shelton & Jones, 1996; Sparks & Richardson, 1997; Vukelich & Wrenn, 1999), yet 80% of teachers report they are ill-prepared and uncomfortable teaching in current technology-rich environments.

Technology does become an effective part of a successful learning environment merely by its presence (OTA, 1995). Traditional approaches to bringing teachers and computers together are notorious for their failure to affect any kind of positive change (Darling-Hammond & McLaughlin, 1995; Sparks, 1997). These approaches refer to the process of presenting computer concepts during a short-

duration in-service training session, described by Sergiovanni and Starratt (1998) as being highly structured, very directed in nature, and designed and implemented outside of the input of teachers. Edward Joyner (in Senge et al., 2000) coined the term *drive-by staff development* to describe a process whereby teachers attend staff development without taking into account what they already know. Content is simply delivered. Participants and instructors don't communicate with each other and both part company at the end of the session. This concept of "drive-by staff development" assumes that teachers are solely responsible for translating basic computer concepts and techniques into new teaching strategies (Senge et al., 2000).

The literature suggests that the teachers' perceptions of technology professional development is that it fails to provide them with the ability to translate skills into practice (Cunningham, 2001), and that professional development becomes an afterthought (Sparks, 1997). Teachers may still remain skeptical about the value of the use of computers in the classroom (Chin & Hortin, 1993) and perceptions about the usefulness of computers will shape the decisions teachers make regarding their desire to change their teaching environment to include computers (Pajares, 1992). The skepticism is easily understood as the reforms starting in the 1980s that included a growing infusion of computers have done little to achieve the results that were intended (Clark & Astuto, 1994).

Technology has been finding a way into classrooms for decades, yet the level of integration continues to be limited (Hope, 1997a, 1997b). Ultimately, as schools continue to pour computers into classrooms, teachers bear the responsibility for

making technology useful to support their instructional process. Technology professional development is considered a primary vehicle for school-wide computer implementations. Barriers to integrating computers into instructional practice are understood (Cunningham, 2001; Guha, 2000; Guskey, 1986; OTA, 1995; Sheingold & Hadley, 1990). With this understanding, why do so few teachers report being ill prepared to use computers in the classroom?

Rationale for the Study

The implementation of computers into school environments has been said to have the potential for a transformative impact in the learning environment (Strudler, 1994). The integration of computers into instruction within K–12 schools is very low (Browne & Ritchie, 1991; Fawson & Smellie, 1990; Schrum, 1999; Siegel, 1995) and budgets for the support of technology staff development can be described as limited (Siegel, 1995). The available dollars for this important function must be used to the greatest advantage and it is important that the design of technology professional development meets the needs of teachers.

The OTA (1995) reported that much of the research in the area of technology implementation in K–12 school systems focuses on the impact it has on student achievement. The report also suggested that there is a gap in understanding how teachers perceive how technology professional development supports classroom instruction. It is vital that understanding how teachers perceive whether current technology professional development is bringing them closer to applying technology

in the classroom. Technology implementation is a complex process and requires substantial budgetary considerations (McCampbell, 2001). Yet, after substantial investments in technology, teachers are still ill-prepared to use technology in their classroom. It is here that we find a vital need for study focused directly at what teachers perceive is important regarding developing their technology skills and the extent to which schools are addressing these needs.

This study provides support to the existing body of research by creating a clearer understanding of the gap between what teachers feel they need to be successful using technology in their classrooms and how schools are addressing their needs. The results of the study should better inform school leaders, technology coordinators, and curriculum designers about factors that are necessary for successful technology implementation within classroom instruction.

Methodology

This approach to this research was a multimethodological approach, incorporating both qualitative and quantitative methods for data collection and analysis. The technique of individual interviews was used as the method for qualitative study and a survey was administered for the quantitative study.

Quantitative Study

A survey was designed to collect data regarding teachers' perceptions of barriers to technology implementation and their perceptions of how well technology

professional development has removed these barriers in their own school systems. The development of the questions for this instrument first emerged from recurring themes found in the literature. These questions were reduced and refined. Finally, support from existing surveys was utilized as a reference to strengthen construct validity. Support for questions regarding barriers to technology implementation was found within the survey issued by the Department of Educational Accountability at Montgomery County Public Schools in Rockville, Maryland. This survey is one in a series of survey instruments published by the U.S. Department of Education (1998) in the Office of Educational Research and Improvement under the title *An Educator's Guide to Evaluating the Use of Technology in Schools and Classrooms.* In addition to this instrument, the survey used by John A. Ellis (1987) in his doctoral dissertation, *An Analysis of Perceptions of Indiana Secondary Teachers Regarding Components Deemed Important to Effective Staff Development Programs,* provided additional support for questions related to issues of teacher involvement, support, and technology professional development availability. This survey was field tested and also drew from questions used in a national study of professional development conducted by Thompson and Cooley (1986) to reveal the characteristics of outstanding staff development programs. The survey was administered via the Internet through the use of a secure web site and was extended to teachers in an intermediate school district in a Midwestern community.

The results were analyzed using the Statistical Package for the Social Sciences (SPSS). The data were analyzed using a comparison of means to evaluate the

differences between the perceptions of teachers' agreement with components identified as barriers to integrating technology into instructional practice and their perceptions of how well their schools have overcome these barriers with an a priori p set to .005, which is a traditional value in social science research (Hinkle, Wiersma, & Jurs, 1994).

Qualitative Study

Personal interviews were used to collect data from a qualitative perspective. Through a referral process, teachers were invited to contact the researcher for the purpose of sitting for a single interview. The questions posed during the interview focused on perceptions of technology professional development and personal experiences using technology in the classroom. These interviews were recorded by audio tape.

Evaluation of the data collected from the interviews was performed by transcribing the tapes using a word processor. Grounded theory was used as the methodological approach for data analysis.

Definitions

Multimethodological study—the design of a research study which incorporates the use of both qualitative and quantitative methods. These studies may take many forms with emphasis on either the qualitative study, the quantitative study, or equally distributed between the two. They may be conducted sequentially (one

study followed by another) or concurrently (both studies conducted at the same time). This study uses a concurrent triangulated strategy.

Professional development—"a systematic attempt to bring about change—change in the classroom practices of teachers, change in their beliefs and attitudes, and change in the learning outcomes of students" (Guskey, 1986, p. 5).

Technology—myriad examples of technology abound including video cameras, digital cameras, video disk players, scanners, personal computers (both desktop and laptop), and personal digital assistants (PDAs) (Hope, 1997b). For the purpose of this study, the term *technology* will be used to refer to personal computers (e.g., desktop, laptop, or tower).

Limitations of the Study

It is understood by the researcher that each school is a unique institution guided by dynamic leadership characteristics, unique communities, and unique state and local guidelines. In order to seek a comprehensive understanding of teachers' perceptions of the important characteristics of technology professional development and the extent to which these factors are being implemented, the study included schools from rural, urban, and suburban settings. In addition to the school settings, the size of schools varies from less than 1,500 to over 25,000 students. This study is limited to a single region in the state of Michigan and focuses only on teachers in a public school system setting. Data were collected using two separate methods. The first was the use of a survey which was administered from a server on the campus of

Western Michigan University. Because it is possible that other variables influencing teachers' perceptions outside the barriers defined in the survey had not been accounted for, an additional qualitative component was used to limit this concern. The results of this research should be helpful in order to inform school districts about possible disparities between barriers to technology professional development and the degree to which the teachers that perceive these barriers are actually being addressed. With this in mind, it is important to understand that these limitations make generalizing to the broad-based educational community suspect.

Organization of the Study

This dissertation will be organized into five separate chapters. Chapter I outlined the statement of the problem, the rationale for the study, an overview of the methodology, the purpose of the study, the research hypotheses, limitations of the study, and an overview of the study.

Chapter II includes the literature review and will outline the influence of leadership support, will define professional development, teachers' perceptions of professional development, the role of the technology coordinator, and the importance of technology support, and will describe the barriers to integrating technology within schools. These barriers are detailed in Chapter II and include the time teachers have for practice and experimentation with new technology, the access to technology training and professional development, the teachers' involvements in the design of technology training and professional development, the presence of lack of having

immediate access to computers, and technology support following technology training and professional development.

Chapter III will describe in detail the method and methodology for this study. This includes the development of the questionnaire for the qualitative survey and the process to outline the questions for the participant interviews. Additionally, the process of the pilot study, method for collection of the data and steps to ensure anonymity, and procedures for data analysis will be carefully presented. Finally, five hypotheses will be presented at the end of Chapter III.

Chapter IV presents the findings of the data analysis, and Chapter V contains the summarization of the results. Chapter V will also contain recommendations for how this research can be used to guide future technology implementations within school systems.

CHAPTER II

REVIEW OF THE LITERATURE

The purpose of this study was to understand how the technology professional development needs of teachers were being addressed within K–12 systems. Habermaas' theory of Lifeworld and Systemsworld, as it is embraced by Sergiovanni (2000) from a leadership perspective, was used to understand how schools are addressing teachers technology professional development needs. The findings of this study are a result of multimethodological study, combining a survey administered to teachers via the World Wide Web, and individual teacher interviews. This study was conducted in the state of Michigan.

Technology in K–12 Education

Technology has been moving into the educational environment for decades (Cuban, 2001). In all this time we still find limited application and teachers who feel unprepared to use technology in their classrooms (OTA, 1995).

Simply placing computers into the classroom challenges the existing organizational structure. However, by doing only this, we cannot be expected to have the anticipated transformative results (Levinson & Doyle, 1993). Not only does the existence of technology change the culture of the classroom, but it also has an impact on the entire educational organizational structure (Hope, 1997a). Culture plays a

significant role in how technology is integrated into the K–12 environment (Prain & Hand, 2003). Integrating computers into the classroom environment may be helpful in nurturing a more positive learning experience, but it can also be responsible for creating greater stress for teachers, and it can act as a barrier to the educational process (Hope, 1997b). The infusion of computers into the classroom beginning in the early 1980s has not slowed down and the level of discomfort with technology continues to be a barrier (Vojtek & Vojtek, 1997). Inadequate professional development has been cited as a major reason for less than adequate results (OTA, 1995).

The implementation of computers into the classroom environment can be costly and complex (Conca, 1996; Dede, 1997) and requires careful planning to ensure that computers and software meet the instructional needs of the teacher, and to ensure that the teacher has the capacity to utilize the new technology in a way that considers the classroom (Osterman & Kottkamp, 1993). Building the teachers' capacity requires an understanding of where teachers are with respect to their current needs and knowledge of computers (Guhlin, 1996) and their understanding of how the computer can be used to enhance the learning environment (Chin & Hortin, 1994). Professional development can make the difference between a computer sitting idle in the corner of a classroom and a computer being used as an integral component of the educative process (Buchsbaum, 1992). However, professional development programs must be carefully planned, well supported, and ongoing. The lack of a good professional development plan can contribute to higher levels of stress, frustration,

and burnout (Brodinsky, 1984; Chin & Hortin, 1994). Higher stress and lower morale will be evident in conditions where staff development does not relate to desired teachers' expectations, does not emanate from the voices of the teachers, or does not exist at all (Hope, 1997b). Lack of control regarding decision-making that directly affects working conditions may be associated with burnout (Jenkins & Calhoun, 1991).

Leadership Support

Leadership plays a critical role in the deployment of successful professional development for teachers (Hope, 1997b; Senge et al., 2000; Sparks, 1997). Effective educational leadership lays the foundation for a healthy school culture and in the context of technology implementation should have at its core the mission to assist teachers through well-designed support structures and the persistent focus on removing barriers that prevent teachers from using technology. This necessitates a clearer understanding of leadership and how systems thinking can create a dynamic and supportive structure for technology implementation.

Inherent in the systems approach to developing organizations is the assumption that leadership is a moral process (Burns, 1978; Gardner, 1990; Senge, 1990; Sergiovanni, 1992) and that the approach to leadership is from the perspective of a leader being a teacher and a steward (Senge, 1990). The development of a learning organization is described by Peter Senge (1990) within five processes or disciplines. Sparks and Hirsh (1997) lend support to Senge's systems thinking

approach as it applies to technology professional development for teachers: "Because educational leaders typically have not thought systemically, reform has most often been approached in a piecemeal fashion" (p. 6).

The five disciplines include mental models, personal mastery, team learning, shared vision, and systems thinking and are defined below. The first discipline is that of mental models. Mental models are those assumptions and beliefs the each of us holds about the world around us that guide our decisions and actions. Sharing mental models in creative atmospheres can help reinforce successful integration of new strategies (Caine & Caine, 2000). The development of a personal vision requires that we construct our beliefs and assumptions in the context of where we would like to be and where we are currently. By looking at both, we can seek to discover the creative tension between the two and move to eliminate the gap. This first discipline directly addresses the environment we find teachers in at the time of any new technology implementation. New technology can challenge the existing personal vision of a teacher requiring their own reassessment and development of a new vision. The creative tension is found between where the teachers' skills and abilities lie regarding utilizing the new technology and where they would like these skills and abilities to be.

The process of personal improvement and the skills necessary takes us to the second discipline, personal mastery. Personal mastery is a process whereby individuals seek excellence and understanding in their own environment. When leaders wish to draw upon followers, they need to ensure that they have created the capacity for the followers to excel (Sergiovanni & Starratt, 1998). As part of a comprehensive school-

wide technology implementation, there must be substantial planning for technology professional development (Cooley, 1998). Teachers cannot be handed new technology without proper measures being taken to ensure that they have the capability to appropriately utilize the equipment in a way that supports their instructional process (Schofield, 1995).

Solid foundations in the development of mental models and personal mastery create the possibility for team learning. The process of team learning seeks to differentiate between dialogue and discussion in favor of dialogue. During dialogue, personal assumptions and positions are suspended within a group in order to generate ideas. This process requires that the environment is safe. Effective leadership seeks to promote risk-taking (Kouzes & Posner, 1993; Senge, 1990; Yukl, 1989) and the suspension of positional power and stature must take place here (Senge, 1990). During the process of team learning, the vision must be allowed to develop. This can be a messy process and sometimes chaotic at first, but these are natural to any healthy learning organization (Wheatley, 1992). In an educational environment, team learning should create the opportunity for teachers and administrators to dialogue regarding the use and application of technology in the classroom, how technology professional development should be designed and delivered to meet these needs (Sergiovanni & Starratt, 1998), and how support and coaching (Guskey & Sparks, 1996) can be designed into the system to ensure a sustained effort for change. Team learning creates an environment for teachers and administrators to exchange ideas and build on successes and failures in order to solidify the integration of technology into the

instructional design. This supports knowledge construction and works to build capacity (Darling-Hammond & McLaughlin, 1995).

This development of vision from the groups takes us to what Senge (1990) calls shared vision. A shared vision is a process that far exceeds the presentation of a vision by the leadership. While it is critical that the effective leader should seek to communicate the vision of the organization (Bass, 1985; Bennis & Townsend, 1995; Hackman & Johnson, 1996; Senge, 1990), it must also be internalized and accepted by the followers (Kelly, 1992). Failure to develop a shared vision of technology implementation for teachers can diminish success (Strudler, 1994). The creation of exemplary followers requires that they truly believe in the vision and are actively involved in its success. From this shared vision comes the process of systems thinking. Senge (1990) indicates that at this level we stop thinking about small individual pieces of the organization, and look to larger systemic processes. Often the causal chain is far larger than we expect, and because of this our actions actually create greater systemic problems (Senge et al., 2000). So how does systems thinking have an impact on the educational process?

The process of preparing teachers to use technology in the classroom may be approached with a very narrow focus. As a leader, the building administrators needs to take into account the individual teachers mental models and clearly understand whether the professional development actually fits into their own instructional design (Hirsh & Sparks, 1999; Osterman & Kottkamp, 1993). Participation in training should enhance personal mastery of technology and align with improving student

learning (Guskey, 1986, 1997; Hirsh & Sparks, 1999; Sparks & Richardson, 1997). Teachers are by no means a homogeneous population of technology users (OTA, 1995). While younger teachers may have some experience using technology, many others have completed their teacher training long before computer technology was a reality (Armstrong, Davis, & Young, 1996). Furthermore, there is no guarantee that teachers coming out of existing teacher education programs in colleges and universities have similar computer and technology experience (Strudler, Heflich, & Anderson, 2000; Strudler & Wetzel, 1999).

Do support systems and collegial associations exist to enhance this experience through team-learning mechanisms? Long-term systemic change can only occur when a process or activity becomes a part of the culture of the organization. Local support structures and relationships are critical to the vitality of the organization (Kouzes & Posner, 1995). The shared values, norms, and beliefs of the school provide the necessary material to bond people together in common causes and activities, thereby creating a culture which is better defined as a learning community (Sergiovanni & Starratt, 1998).

The term *drive-by-staff-development* (Senge et al., 2000) was used to describe professional development where teachers attend a single, isolated event. Engaging in activities that do not align with the shared vision creates divisiveness within the organization. Shared visions are developed over time and permeate the organization, giving guidance, focus, and energy for learning (Senge, 1990).

The principal is a critical player in the leadership role regarding technology implementation for teachers. In this leadership role, principals must work to develop a vision for technology purchases and utilization (Meltzer & Sherman, 1997). Technology implementations devoid of a clear vision for use will most likely render further technology professional development ineffective (OTA, 1995). As a key figure in technology implementation, principals are expected to facilitate the focus, support, and guidance necessary to help teachers become computer literate (Armstrong et al., 1996). They must become an advocate for the teachers and seek to encourage them to pursue unique approaches to applying technology as it aligns with their own pedagogy (Meltzer & Sherman, 1997). An important characteristic to the leadership in the context of technology implementation is that risk taking is to be encouraged and that it is safe to make mistakes (Kouzes & Posner, 1995; Sergiovanni & Starratt, 1998). The process of learning is all about making mistakes, and the necessary process of critical reflection allows the teacher to actively engage in the cognitive process of improvement through individual contemplation.

This process of learning should be couched within a teacher's personal vision for learning, and within his or her own educational platform (Sergiovanni & Starratt, 1998). This platform allows the teacher to develop, through continued critical reflection, a value-centered instrument that guides daily practice. Methods and measures should assist in the achievement of the value-based goals. Sergiovanni (2000) refers to these two entities as the "lifeworld" and the "systemsworld." Borrowed from the German philosopher Jürgen Habermaas, Sergiovanni (2000)

contends that the lifeworld is defined by the needs, values, and culture of the organization. The systemsworld is dominated by strategic action, assessment, and policy development. In a well-balanced organization, the lifeworld should be central to the movement of the organization. Testing, evaluation, and strategic planning (which should include technology professional development planning) should all be established to support the norms, values, and beliefs of the organization. If this process is inverted, it can be said that the systemsworld has colonized the lifeworld. In this environment, the focus in the educational community becomes centered on testing, assessment, and strategic planning (Sergiovanni, 2000). These structural elements act outside of the purview of the norms, beliefs, and values of the organization. Technology professional development must be a supportive process to the organization, not something that is imposed from outside the organization.

Habermaas (1984) defines the structural components found within the lifeworld as being *culture, society,* and *personality. Culture* refers to the stock of knowledge from which participants come to understand meaning and interpretations within the context of their own world. *Society* concerns itself with the establishment of solidarity and is derived from the formulation of legitimate orders through which individuals regulated through means of their memberships in social groups. Finally, *personality* reflects individual competences that develop their ability to come to their own understanding and to develop autonomy and identity which results in the assertion of their individual identity.

A lifeworld centered organizational culture, where mechanistic structures, defined by teleological and strategic actions, support the normative and expressive actions of organizational lifeworld, should reflect a healthy *culture, society,* and *personality*. Teleological action embodies goal setting and designing systems to achieve the goals. Strategic action is process oriented as a value based decision making process for deciding among alternative actions. Sergiovanni (2000) states that in organizations where the lifeworld is eroded through colonization, there is a loss of cultural meaning and traditions; disruption of society disconnects individuals' sense of belonging and the perception of being a part of something important; and a dissociation of personality from society and community becomes a generative process for isolation and disconnection from the larger community.

Technology must support the norms, values, and beliefs of the school community. It must relate to student learning (Guskey, 1986, 1997) and be a part of a community effort (Senge et al., 2000; Sparks, 1997). In a school community focused on normative and expressive action, technology, with the careful design of technology professional development, can provide the necessary connections between individuals and community.

Professional Development

From the literature, we find that the term *professional development* can be understood in many ways. Various terms have been used interchangeably to try to

describe professional development, and even these terms may have different meanings for different people.

The term *professional development* has actually been referred to by a variety of names including *staff development, professional development, in-service education,* and *staff training* (Schwartz & Bryan, 1998), although these terms may have different meanings for different people or groups (Sparks & Richardson, 1997). Sparks and Hirsh (1997) interchange the terms *staff development, in-service education,* and *professional development.*

Beeler (1977) referred to professional development as an activity to "enhance the competencies, skills and knowledge of individuals and to enable them to provide better services to the clientele" (p. 38). Professional development should provide for professional growth for the purpose of acquiring and refining skills to meet growing needs (Cannon, 1981) and should emphasize knowledge, skills, and attitudes necessary for teachers while focusing on the learning and performance needs of students (Sparks & Richardson, 1997).

In a very basic form, staff development has been described as a process designed to provide staff to grow professionally or personally (Schwartz & Bryan, 1998). It is generally accepted that the term *in-service workshop* defines the process where teachers attend short-term workshops or formal courses (Truitt, 1969). At a foundational level, the process of professional development can be thought of as a plan to provide opportunities for teaching staff to grow professionally or personally (Schwartz & Bryan, 1998). Cannon (1981) described professional development as an

opportunity for "general professional growth, refinement of existing skills, and acquisition of new skills to meet changing needs" (p. 447).

Sergiovanni and Starratt (1998) described *in-service education* as being highly structured, very directed in nature, and designed and implemented outside of the input of teachers. This is commonly viewed as a process where teachers engage in a short-term session—usually 2 to 3 hours, and sit passively while new ideas and concepts are presented. Truitt (1969) suggested that in-service workshops include "workshops, formal courses, weekly or semiweekly staff meetings, discussions between student leaders and staff members, professional seminars, and attendance at national and state professional conferences" (p. 2).

There is a continuing trend in the K–12 school systems to introduce technology into the classroom. Although these new technologies can encompass a variety of tools (e.g., automated video systems, computers, interactive video disks, student assessment and curriculum development systems), the computer is the focus of this investigation.

Various terms have been used interchangeably to describe professional development. *Technology professional development* will be defined here as the process to develop a learning experience for teachers with the intent of providing them with the tools to integrate computers into their instructional practice.

Ideally, professional development should be a positive and productive process. It should seek to enhance the educational experience of the teachers, administrators, and students by strengthening and enhancing teachers capacity. Professional

development is "a systematic attempt to bring about change—change in the classroom practices of teachers, change in their beliefs and attitudes, and change in the learning outcomes of students" (Guskey, 1986, p. 5). Lieberman (1995) described staff development as the development of a continuum of practices that serves to encourage teachers to grow, while Sergiovanni and Starratt (1998) indicated that staff development focuses on developing professional expertise through the involvement of teachers in problem-solving and action research.

The purpose of staff development, as it applies to computer technology, is not to learn about the computer abstractly, but to apply what has been learned directly into the cognitive framework of teaching environments. Its purpose should be to focus on the knowledge, skills, and attitudes of the teachers and administrators for the purpose of improving student performance (Sparks & Richardson, 1997). For this to occur, following adult learning theory (Cross, 1981; Knowles, 1990), the technology staff development must be relevant to the environment for which it is to be applied, placed within the context of the learner and the anticipated environment, and problem centered. It is important, then, to understand the best possible means of developing teachers' abilities to integrate the use of a computer into their individual teaching environment.

At the same time, this process must provide the flexibility to support the idiosyncratic nature of teaching paradigms. It cannot be a "cookie-cutter" program. It must address the gap between the desired skills, attitudes, and knowledge and current levels (Atkins & Vasu, 1998; Brand, 1998; Sparks & Loucks-Horsley, 1989).

Sparks and Richardson (1997) suggested that the focus must be on the knowledge, skills, and attitudes necessary for teachers to perform at high levels. This process is not an isolated event, but should be part of an ongoing process where learning becomes a normal part of teachers' working lives. In such a process, professional development needs to be centered on the context of the teacher within the school environment. Staff development should seek to close the gap between the expected knowledge, skills, and attitudes of teachers and their current abilities (Sparks & Hirsh, 1997). Much of the current staff development focuses on the steps necessary to operate a computer and software and neglect issues of how to reconstruct instructional pedagogy through the infusion of computer technology.

Staff development must produce a change in behavior. Teachers who participate in staff development must move from a position of not using the skills and techniques presented, to a position of applying the newly acquired skills directly into their teaching environment. The literature clearly speaks to the issue of teachers who attend one-shot training sessions where a series of computer skills are presented (Galbo, 1998; Osterman & Kottkamp, 1993; OTA, 1995). The application of computer skills is unique to each teacher's environment. Naturally occurring communities, such as teachers within similar disciplines, may create situations where the implementation of computers can have similar uses. For each teacher though, the experience is unique. The focus, then, should be how to create a deeper understanding of how computers fit into learning environments, not to teach

puter skills.

The computer (and related software and peripherals) is a tool that teachers should use when it supports the reality of the classroom experience (Conca, 1996). It can only benefit when applied appropriately. Used improperly, it can be experienced by the teacher and the students as clumsy and frustrating.

Staff development must be considered a critical foundation of the continuous school-improvement process and schools must be prepared to invest substantially (OTA, 1995). The current investment in technology staff development is below 15%, which is well below the suggested 30%.

Teachers engage in their craft as they were taught and typically with the tools with which they learned (Hope, 1997b; Myers, Miels, Ford, & Burke, 1997). If the college of education from which they graduated included few or no computer classes and if the faculty of that college integrated little technology into their own curriculum, then new teachers most likely will avoid using technology themselves. These teachers cannot be expected to change the way they teach without first having the structured opportunity to learn new techniques (Sparks & Richardson, 1997).

Traditional methods for technology professional development for teachers may rely on canned training materials offered in block schedules (Browne & Ritchie, 1991). In many instances, the goals are not clearly understood, the training is not timely, and it does not meet the needs of the individual learner.

A general misconception centered around professional development is that because participants are engaged in staff development, they are therefore ready and willing to initiate change in the instructional practice. Professional development can

increase teachers' use of technology (Phillips, Nachtigal, & Hobbs, 1986) and reduce anxiety in teachers (Ernest & Lightfoot, 1986), but the mere attendance at a traditional technology training session is not sufficient to increase teachers' use of the new technology.

Teachers may use computers in a variety of ways. Teachers may use file management and spreadsheet software to assist in budgetary development and record keeping (Ike, 1997). Using applications software such as PowerPoint, teachers can develop presentations that include graphics, sound, video, text and dynamic links to the Internet (Myers et al., 1997). With varied applications for teachers to use technology in their classroom, it is important that they understand how it is to be use to enhance their educational environment. If teachers don't embrace the value of technology it cannot reach its full potential (Hope, 1997b).

Teachers' Perceptions of Professional Development

There is a large body of literature that reveals ideas for exemplary technology professional development (e.g., Browne & Ritchie, 1991; Buchsbaum, 1992; Cooley, 1997; Darling-Hammond, 1998; Green, 1993; Schrum, 1995) technology implementation (OTA, 1995), the positive role technology can play in education (Strudler, Falba, & Hearrington, 2001). The literature also makes clear the necessity of focusing on students learning when designing professional development (Darling-Hammond, 1998; Guskey, 1986, 1997). Teachers' perceptions (Chin & Hortin, 1994) and personality (Katz, 1992) can have a substantial impact on how technology is used

within the curriculum. It would be optimistic to believe that recent graduates starting their first teaching positions were necessarily well versed in technology (OTA, 1995; Strudler, McKinney, & Jones, 1999). Students graduating from colleges of education hold on to the conviction that computers and computer-related technologies are important for K–12 education. Yet, of the students surveyed, a majority of respondents rate their computer skills as low. They also indicated that their use of computers was minimal (Topp, 1996). According to the Office of Technology and Assessment in their 1995 report, a gap in the literature exists specifically in the area of teachers' perceptions regarding technology professional development.

Role of the Technology Coordinator

The implementation of computers into the school environment requires critical planning, which involves elements such as needs assessment, hardware and software selection, installation schedules, training and support, and maintenance. The acquisition of computers and related technology has been known to sit in storage because the explicit tie to curriculum was not predetermined (Buchsbaum, 1992). A pivotal position in the computer installation process is the technology coordinator.

The arrival of computers may create ongoing organizational change. The technology coordinator is considered a critical change agent. Moursund (1985) suggested that the necessary skills of any technology coordinator include a dedication to education and managerial skill, an understanding of the educational system and educational change, excellent communication skills, and technical knowledge in both

computer science and computer education. Moursund also emphasized that a clear understanding of learning theory is important.

Technology coordinators are clearly responsible for many different facets of the educational technology picture and necessary for technology implementation in K–12 systems (Strudler et al., 2001). Of the many roles they must play, one of the most important is providing support for teachers (Marcovitz, 2000). The support a technology coordinator can offer ranges from simply walking around to check in on teachers to designing the school-wide technology professional development program. Their abilities should combine technical, interpersonal, and organizational skills (Strudler, 1994). It is not enough to be able to move around to different classrooms to attend to the nuts-and-bolts maintenance necessary to keep equipment running. This contact with teachers provides perfect informal opportunities for professional development. Questions referring to the use the computer within the context of instructional design may require immediate attention. By applying adult-learning theory (Cross, 1981; Knowles, 1990) to this technological environment, we come to understand that the immediacy of application, supported by the technology coordinators, should develop deeper learning and understanding. Creating an environment where learning is successful is best situated in a social network (Brookfield, 1987). Understanding how to operate the computer is more than just learning skills (Browne & Ritchie, 1991).

Unfortunately, as important as this critical position is to education, the Office of Technology Assessment (1995) reported that the current ability for schools to

provide this support is very limited. At the time of the report, only 6% of elementary schools and 3% of secondary schools provided full-time school-level technology coordinators. Even more dismal was that fact that three-fifths of schools did not have anybody with computer coordinator support activities for even a part of their workweek.

The role of the technology coordinator remains a critical element of the technology implementation process (OTA, 1995; Strudler, 1994). There is a long history of underutilized computers in classrooms and computer labs and it appears that one of the elements that may tip the scales toward providing and environment for teachers to succeed is the technology coordinator (Strudler, 1994).

The implementation of computers into the school environment requires critical planning. Technology professional development must be considered as an important part of the overall plan for ongoing improvement in any school system.

Technology Support

It does no good for teachers to try to convey how they intend to use a computer to address a pedagogical approach to learning if the technology support staff knows only about the computer and nothing about teaching. For a teacher to struggle in isolation regarding the use of technology in the classroom can lead to a negative impact on morale and becomes a factor that contributes to teacher burnout (Brodinsky, 1984; Chin & Hortin, 1994). For teachers to find answers to their

questions cannot be left up to chance; the designation of a technology specialist must be a well thought out, deliberate act (McDiarmid, 1994).

The level of complexity of the technology implementation will direct the depth of the support system necessary. In a smaller school with limited technology, it may be possible to utilize an individual teacher or media specialist who becomes the "expert" in the school. In larger schools with extensive technology infrastructures, it may be necessary to hire individuals with engineering backgrounds to maintain the infrastructure along with media systems coordinators who oversee distant learning projects, develop training, and coordinate educational assistants in each building (Cooley, 1997).

The technology specialists must be involved in the process for planning any technology implementation. This is a critical component that must be embraced by the technology coordinator who is working in conjunction with building administrators. School administrators are making a critical long-term mistake if they wait to see if teachers are using technology before they consider providing support (McDiarmid, 1994). By the time teachers get to a point where they are dissatisfied with the technology, cultural erosion has already occurred. Low morale and technology burnout are serious issues (Brodinsky, 1984) that, like the loss of trust in an organization, are very difficult and time-intensive to rebuild (Kouzes & Posner, 1988). Support needs to be considered a high priority in any technology implementation and has to be carefully designed and assessed (Darling-Hammond & McLaughlin, 1995; Hope, 1996, 1997b).

Barriers to Integrating Technology

The integration of computers into schools and classrooms must be a challenging prospect simply because it implies change (Birman, Desimone, & Porter, 2000; Hope, 1997b). The prospect of change is often difficult on an individual level. At an organizational level, the process of change is something that must be carefully guided.

The culture of an organization is understood by the norms, values, artifacts, symbols, and rituals of the people (Harrison, 1987). Guiding change in any organization is an extremely difficult prospect for leaders. In business, organizational change is rarely successful (Senge, 1999) and is confounded by many of the same challenges which stifle change in schools. Attempts at change are sometimes viewed as the latest and greatest fad. These changes are often imposed upon the organization instead of grown from within; that is, in business, leaders often determine change regardless of the willingness of those in the organization.

The implementation of computers into a school setting begins a substantial change process and building administrators and technology coordinators are recognized as key change agents (Strudler, 1994). Understanding and removing barriers to accomplish meaningful technology integration is not an option. Themes that continue to reappear in the literature include time, training and development, involvement in the design, access to equipment, and support (Hadley & Sheingold, 1993; Hope, 1997c; OTA, 1995; Sheingold & Hadley, 1990). Further elaboration of these themes follow.

Time for Practice and Experimentation

Technology can be a very difficult area for teachers to embrace. The term *user-friendly* is really a misguided description of any computer regardless of the hardware or software, yet it is used often. Telling teachers the computers are friendly does little to soften the impact of technology moving into their teaching domain (Hope, 1997a). Teachers who have been in the profession for years may have little or no experience with computers, so their resistance will be not only with fear or apprehension toward technology, but with the idea of reconfiguring their curriculum to suit the technology (OTA, 1995). Computers are often placed into a classroom setting where the students have more computer expertise. Imposing technology on teachers who are already apprehensive about computers and change will only increase fear in the classroom ((Hope, 1996;1997a). Overcoming the fear of using new technology and redesigning teaching strategy requires a substantial investment in time (Siegel, 1995). It has been estimated that at least 30 hours of practice and experimentation are needed to bring teachers to a basic level of comfort. The literature clearly supports that the more time teachers have to spend working with the new technology, the more comfortable they feel and the more they are willing to experiment (Hadley & Sheingold, 1993; Moursund, 1998; OTA, 1995; Sheingold & Hadley, 1990; Shelton & Jones, 1996).

Access to Training and Development

The barrier to integrating computers into the curriculum is due to the failure to provide any form of training and development. Budgets for technology professional development typically fall below 15% of the technology budget. This falls well below the 30% that has been recommended (OTA, 1995). Neglecting technology professional development leaves teachers with the task of learning how to use the computer as well as how to weave it into the fabric of the curriculum.

Training and development is constantly referred to in the literature as a critical structure for successful technology implementation (Darling-Hammond, 1998; Darling-Hammond & McLaughlin, 1995; Guskey, 1986, 1997; OTA, 1995; Schrum, 1999). Training and development are instrumental in preparing teachers to integrate technology into their practice (Prain & Hand, 2003). A typical model for technology professional development is centered around what has been defined as single event or "sit-and-get" sessions (Meltzer & Sherman, 1997; Schrum, 1999; Siegel, 1995; Sparks, 1997). This describes a process where teachers are grouped together to attend a skills training session. Computer concepts are presented while teachers follow along during a 2- to 4-hour session. At the conclusion of this type of training, teachers are no closer to understanding how the computer can be used to transform their classroom then they were prior to attending. In order for this to occur, training and development must be problem-centered (Birman et al., 2000; Mohr, 1998; Sparks & Richardson, 1997).

Models of how adults learn are premised on four characteristics of adult learning. They are (1) self-directed; (2) drawing from a wealth of past experience to be used as a reservoir of learning; (3) experience increases in the readiness to learn relative to developmental tasks of social roles; and (4) learning faster, the more the readiness of direct application for what has been learned is apparent (Cross, 1981; Knowles, 1990).

Constructivism provides an alternative epistemological foundation to learning, holding that real-world experience plays a critical role in learning (Duffy & Jonassen, 1992; Sparks, 1997). This model proposes that learners construct knowledge based on their personal experience rather than simply acting as a passive receptacle (Duffy & Jonassen, 1992; Roblyer, Edwards, & Havriluk, 1997). The need for active involvement in the learning process is evident (Birman et al., 2000; Hope, 1997a; Sparks & Richardson, 1997).

Involvement in the Design of Training and Development

Teachers indicate their desire to be involved in the process of designing their own learning environments and list lack of involvement in the design process as a barrier to technology use (Hadley & Sheingold, 1993). Professional development should be a process that is concerned with creating an environment where learning is the focus, not presentation. In-service presentations are notorious for presenting to a passive audience. Learning requires that there is an active engagement with the

learners and for this to take place, the learning activity must be problem-centered (Cross, 1981; Knowles, 1990).

Regardless of the level of experience of the teacher using the technology, the process of technology must be designed to meet individual needs (Meltzer & Sherman, 1997). To create a sense of ownership during the design process is important, and excluding teachers from the planning process of technology development would only alienate them. This would result in poor utilization of technology at best (OTA, 1995).

There are a variety of approaches to the development and implementation of professional development. One approach to professional development is to bring in an expert in some form of pre-designed, step-by-step instructional system (Browne & Ritchie, 1991; Clifford, 1998). The skills and techniques to be introduced already have been determined and laid out in a time-sequenced fashion. Teachers are either enlisted to take a particular sequence of training seminars, or they are allowed to pick and choose the courses in which they wish to participate. While the latter method can create the illusion of self-determination through individual selection, neither situation addresses the requirements of participation in the staff-development process. Some of the literature suggests that involving the teacher in the design of the content and format of the professional activities is integral to the process (Birman et al., 2000; Hope, 1997a; Sparks & Richardson, 1997) and that support from teachers and staff can solidify when involved with building administrators from the onset of the design process (Cooley, 1997).

Being afforded the opportunity to choose does little to create an environment for sustained change. These methods of approaching staff development presuppose the existence of an absolute truth regarding learning and the dispensation of knowledge. Ideal methods of knowledge transmission and acquisition are determined so that instruction can be fashioned into an eloquent, foolproof delivery system. For those with little teaching experience, or lacking an understanding of knowledge acquisition, this is a sensible, pragmatic method of dispensing knowledge. In contrast, the teacher is able to construct knowledge around the new technological tools based on their own experience. This approach to learning combines social cognition and constructivism (Duffy & Jonassen, 1992).

A major stumbling block in the process of implementing change is that it is imposed. When seeking to initiate change by investing in technology, leaders must be cognizant of the importance of inclusion when designing learning strategies. It is important for the teachers to be able to voice their concerns and to determine how they are going to learn, when they should learn, and what they are going to learn. Imposing pre-designed "canned" technology training sessions rarely addresses individual needs.

Individuals draw from a wealth of past experience (Cross, 1981; Knowles, 1990). Each person has a unique set of skills and knowledge based the past experiences. These skills and this knowledge are used to create new learning. The extent to which professional development can expect to be successful depends, in part, on the flexibility of the design during its delivery. The research around social

cognition and constructivism clearly supports that it is necessary to allow participants an opportunity to shape abstract concepts into practical applications by constructing knowledge based on their own experience (Duffy & Jonassen, 1992; Sparks, 1997).

The effective application of technology professional development requires teachers to come together to learn about applying new technology (Birman et al., 2000; Mohr, 1998; Sparks & Loucks-Horsley, 1989). A community of learners creates a culture that can offer support among its members. This structure supports the development and exchange of new ideas and also will provide assistance for teachers who are experience difficulties. This environment makes experimentation a safe process and provides for future growth.

Teachers are by no means a homogeneous population of technology users (OTA, 1995). In addition, there is no guarantee that teachers coming out of existing teacher education programs in colleges and universities have similar computer and technology experience. Students completing teacher education programs may have very limited or no exposure to using computers in an educational setting (Strudler et al., 1999)

Does this singular engagement fit within the shared vision of the school? Engaging in activities that do not align with the shared vision creates divisiveness within the organization. Shared visions give guidance, focus, and energy for learning (Senge, 1990).

Immediate Access to Computers

For teachers to attend a training session and then to wait months before they have an opportunity to apply what they might have learned is not unusual. The research regarding the need for immediacy of application is clear (Cross, 1981; Knowles, 1990). The inability to engage in application creates frustration among participants, and the new knowledge quickly dissipates without application.

Staff development should be carefully aligned so that the new knowledge that has been created can be quickly utilized in the classroom. Teachers learn and apply by doing and through reflection (Darling-Hammond, 1999; Darling-Hammond & McLaughlin, 1995; Hope, 1996, 1997b). Planning for staff development must be done at a time when teachers can take immediate advantage of their new knowledge through immediate application. The hardware and software must be in place when teachers are ready to use what was learned in the professional development activity (Meltzer & Sherman, 1997). Ensuring that there are sufficient computers in the teaching environment so that they are immediately available can change teachers' beliefs and teaching practices (Keirns, 1990). Successful implementation of technology is dependent on the availability of resources for teachers (OTA, 1995).

Much of what passes for professional development is actually an in-service activity where concepts are presented to teachers in a more passive style. Using a single computer as a presentation tool, a teacher or consultant presents some of the uses and capabilities of technology. Throughout the presentation, the instructor may cite examples of typical problems that may be encountered and how they were to be

solved. This approach relies on the planning of what is important to be done by the presenter and relegates the participant to an entirely passive role. Anticipated roadblocks and problems are identified and solved by the presenter (Browne & Ritchie, 1991). The instructor becomes nothing more than a delivery system, and the participants are passive recipients of the knowledge. This may not be inappropriate given the proper context, but should hardly be considered comprehensive. Teachers who have little understanding of the possibilities of computers have an opportunity to see some of the things of which they are capable. If a deeper level of learning and applications is to take place the context of the learner must be considered (Knowles, 1990) and the construction of knowledge must be take place with the participant (Duffy & Jonassen, 1992; Sparks, 1997).

As a community, teachers can become a wonderful resource for each other as they explore new learning possibilities together (Senge et al., 2000). However, if experimentation leads to dark alleys and dead ends, they also need to have immediate access to a knowledgeable technical advisor.

Technology Support

Technology professional development must be an on-going process, not a single event. The need to structure a systematic support system is something that cannot be overlooked. The likelihood that a teacher will further his or her understanding and use of technology improves if there is somebody who understands the technology that is readily available (OTA, 1995). Much of the professional

development that is presented is formatted as short, single sessions (Hope, 1997b; OTA, 1995; Vukelich & Wrenn, 1999). This kind of professional development can only provide basic information about the computer or specific software. In the short term, this information can be helpful because teachers may have no idea what the computer is capable of doing. Ultimately, however, teachers are not looking to improve their computer skills. They are seeking ways to improve the instructional process so they can become better teachers, which for many teachers means improving outcomes for student learning (Guskey, 1986).

Improving teaching skills is part of a process necessary for teachers to change their behavior in the classroom. Teachers need to be given the confidence to work with the new technology (Schumm, Vaughn, Gordon, & Rothlein, 1994) and the understanding that a coordinator or a teacher designated at a technical advisor is available to help organize computer curriculum (Kloosterman, Ault, & Harty, 1987). Much of this confidence comes from the support structures available to them during the school year when they are trying to incorporate the use of the computer into the curriculum and lack of access to this kind of support is a major barrier for educators (Schrum, 1995). It is here that active experimentation blends with creativity. This is also where roadblocks and dead ends occur and where support become critically important (Guskey, 1986). In a healthy environment, immediate support is available providing both psychological and technical support as teachers move to experiment and apply newly learned skills. This support must be ongoing and immediately available following the technology professional development process (Cooley, 2001).

The failure of district officials to provide appropriate levels of support for teachers and administrators will likely result in limited or no use of the technology (Cooley, 1997). This support can come from a variety of resources such as teacher networks, building level support staff, and teacher designated technology support. Teacher networks provide useful support by being able to exchange ideas, share difficulties, and resolve problems. Models for success can be shared and can inspire other teachers to apply similar concepts. Teacher networks can also act as a catalyst for generating new ideas and serve to remove the sense of isolation that may be encountered as somebody is struggling on their own (Darling-Hammond, 1999). Technology coordinators can be used to support teachers at a variety of levels. This individual should be knowledgeable about computers and technology, professional development, obtaining resources, and the technology integration process (Strudler, 1994). It is important to keep in mind that the computer is there to improve the educational environment and the skills of the technology coordinator must work to assist the teacher in blending the two together.

Support must also be readily available to assist in computer maintenance. When technological failures occur, they must be immediately attended to. If the computer is to become a tool to improve the educational environment, teachers must believe the technology reliable. Teachers who are experienced with technology can find themselves working to maintain hardware and software problems that detracts from the learning activities that are intended (OTA, 1995). If the computer is not considered a dependable tool for instruction, it will remain unused.

Conclusion

A review of the literature reveals that technology has been a part of the educational environment for decades yet integration remains limited. Teachers are ill-prepared to use computers in their instructional process and technology professional development is not successfully closing the gap. Substantial investments in time, money, and resources will continue to be wasted if a better understanding of how barriers to technology integration are not better understood. The literature reveals the importance of leadership (Darling-Hammond & McLaughlin, 1995; Davidson & Maurer, 1995; Senge, 1990; Senge et al., 2000; Sparks, 1997), effective plans for technology implementation (Browne & Ritchie, 1991; Cooley, 1998; Guskey, 1986; Hope, 1997c), the role for technology coordinators (Strudler et al., 2001; Strudler, 1994), yet success still seems to be elusive. The Office of Technology and Assessment (1995) specifically cites the need for a better understanding of teachers' perceptions regarding technology use in the classroom. The purpose of this study therefore addresses an important gap in the literature by going directly to the teachers to better understand their perceptions of what encourages and limits their use of technology in the classrooms.

CHAPTER III

METHODOLOGY AND PROCEDURES

The purpose of this study was to explore teachers' perceptions of technology professional development. Chapter III explains how the population was identified and the manner in which the data were collected. A rationale for the design of the data collection instrument will be provided and the methods for analyzing the data will be described.

Many elements need to be in place in order for the implementation of technology in schools to be successful. On a district-wide basis, the infusion of technology must be part of a well-defined plan for organizational change. The review of literature revealed that implementation of new technology is not an isolated process, but one of large-scale organizational change. Additionally, within the educational environment, administrators and technology coordinators are key figures as change agents during technological transition. Leadership is a key element in guiding and supporting the process and ensuring that barriers to success are identified and removed. Critical elements are necessary to ensure a successful transition toward using new technology in the instructional environment. Barriers to implementation arise when these elements are ignored. In order to provide for as rich an understanding as possible, a multimethodological approach was used. The study incorporated the use of a quantitative process involving a survey, and a qualitative

investigation involving individual teacher interviews. The researcher used a concurrent triangulation approach for the data collection (Creswell, 2003) in order to offer cross-validation between the methods. The researcher used this approach in order to strengthen the credibility of this study, offsetting inherent weaknesses of qualitative and quantitative methods by drawing on their respective strengths.

The quantitative method incorporated the use of a short questionnaire with 35 questions which required the respondent to make selections using a Likert scale. The questionnaire was used to determine whether there were differences in the perceptions of teachers between the factors reported in the literature as being necessary for technology implementation and whether the teachers believe these factors are being implemented with their schools. The data from the surveys were analyzed using a paired-sample *t* test to compare means between teachers' perceptions of what is important, and the extent to which they believe their school is addressing their needs.

The second method of investigation utilized the technique of individual interviews. A structured interview, using 10 open-ended questions was conducted in order to collect as much rich data as possible about these topics: (a) what teachers believe is important to them regarding how best to learn about and use technology in their classrooms, (b) what their own experiences have been, and (c) how well they perceived their technology needs are being met. The interviews were taped and then transcribed. Following transcription, the analysis of the transcriptions followed the grounded theory approach to qualitative inquiry.

The purpose of the mixed-method study is to confirm the research results through triangulation. Some criticism exists toward the use of combining qualitative and quantitative methods (Lincoln & Guba, 1985), but it is believed that the appropriateness and efficacious nature of combined studies (Firestone, 1987; Patton, 1990) is substantial. A growing number of blended studies are adding important insights into organizational studies (Locke, Spirduso, & Silverman, 1993). In fact, the strength of one method can be used to mitigate the inherent weakness of the other (Creswell, 2003). In this study, the questionnaire, as a tool, is very direct in nature and seeks to confirm teachers' perceptions of barriers to technology integration with their instructional environment and whether they believe their individual schools are addressing these issues in order to overcome these barriers. The use of qualitative methods by means of individual interviews were sought to enrich our understanding of teachers' perceptions through elaboration. Quantitative methods can be persuasive and direct by removing individual judgment. Because of this, quantitative methods create a greater potential for generalization. Conversely, qualitative methods can influence by an enriched depiction of respondents' beliefs (Firestone, 1987). The use of qualitative methods will assist in adding substance to the questionnaire that can fail to reveal teachers' perceptions by the nature of its reductionist design. The positive effect of combining these research methods will be to (a) confirm and corroborate the data through triangulation, (b) provide richer detail for better understanding, and (c) to create the possibility for new understanding and uncovering surprises and

paradoxes that may ultimately lead to further studies (Rossman & Wilson, 1985, 1991).

Research Design

Survey

The researcher developed and utilized his own survey for the study. This survey was constructed to understand teachers' perceptions of the importance of critical issues that should support teachers' abilities to use technology in their instructional process, as well as the degree to which teachers believe their schools are meeting their expectations. The questions for the survey focused on whether teachers' perceptions of these barriers are unified and if these barriers are directly addressed within their teaching environment. The barriers revealed in the literature include *time*, *training and development, teacher involvement, access to technology,* and *ongoing support.* These terms will now be individually defined.

Time is defined as time that is made available within their daily environment for teachers to practice and experiment with the technology that has been made available to them.

Training and development refers to specific participation in training activities that have been designed to assist teachers in implementing technology into their instructional practice as a part of technology professional development.

Teacher involvement refers to the extent that teachers are actively involved in the design of the technology professional development activities.

Access to technology refers to the extent that teachers have technology made available to them following technology professional development activities. This also considers that the technology they have access to is similar to equipment utilized in the technology professional development activity.

Support refers to technology support made available to them following their involvement in technology professional development and considers issues of both hardware and software.

In order to support the face and content validity of these questions, support was sought from surveys that have been used and tested for content validity. Seven questions were developed to address each of the five barriers. These questions were developed based on information revealed in the review of literature. Support for the themes around teacher involvement, support following technology professional development, and availability of similar equipment following technology professional development was found in the teacher perception survey utilized in the teachers' perceptions survey distributed by John Ellis (1987). The questions for this study were derived from a national study conducted by Thompson and Cooley (1986). Additional questions were developed from an extensive literature review and pilot tested prior to distribution of the survey to establish construct validity. Additional support was found in a survey developed by the Department of Educational Accountability at the Montgomery County Public Schools in Rockville, Maryland. This survey is one in a series of survey instruments published by the U.S. Department of Education in the Office of Educational Research and Improvement under the title: *An Educator's*

Guide to Evaluating the Use of Technology in Schools and Classrooms (1998). Demographic data were also collected which included years of teaching experience, grade level taught, gender, hours of formal computer training during the past year, computer experience training prior to teaching, gender, classification (urban, rural, suburban), content area, and participation in the Michigan Teacher Technology Initiative.

The data were analyzed using a paired sample *t* test to compare the means of teachers' responses to perceptions of the importance of the five domains gleaned from literature and the means of their perceptions of the extent to which they believe their school has addressed these five domains. These five domains will be tested at an alpha level of .05. The a prioi selection of .05 was chosen because it is considered a standard level of evaluation for behavioral research (Hinkle et al., 1994).

Individual Interview

The design of this study follows the mixed-method technique outlined by Creswell (2003) and defined as a concurrent triangulation strategy. This process combines both a qualitative and quantitative approach to a research study. Both elements are conducted simultaneously, giving equal weight to both studies. The results of the studies, while analyzed separately, are brought together to be synthesized as a single study.

Six individuals were interviewed in order to better understand what teachers believe is important regarding the design and delivery of technology professional

development. The individuals interviewed were contacted through a referral process and had completed the survey prior to the interview process. The respondents were asked 10 open-ended questions about their technology professional development experiences and their experiences of using technology in their teaching environment. The interviews followed the guidelines of the standard open-ended interview suggested by Patton (1990). This format provides for (a) availability of instrumentation for inspection by others, (b) minimizing variation between interviews, (c) interviews that are focused and efficient, and (d) responses that can be easily compared and analyzed (p. 346). The survey specifically targeted the five barriers to technology implementation that the research aimed to better understand. In order to increase the likelihood that the interviews robustly supported the survey data, the interview questions were more general and only sought to better understand teachers' experience with technology and technology professional development. Issues regarding the five barriers hypothesized, then, were envisioned to emerge naturally from teachers' responses.

After developing the questions, a pilot study was conducted. The questions were developed considering Patton's (1990) concern for the elimination of presupposition for feeling and thoughts that may be salient for the interviewee (p. 354). Truly open-ended questions are designed to allow interviewees to use any words they wish to express feelings and attitudes. Patton's concern is that the development of questions that do not consider this, may lead interviewees in a direction desired by the researcher, therefore limiting the reliability of the study. This

consisted of interviewing a middle school teacher currently teaching within an intermediate school district to be used in the study. The teacher was aware of the research being conducted, and that this interview was only a pilot study. No data from this interview were collected or analyzed. After asking the teacher to respond to a question, we discussed what he felt he heard in the question and why he responded the way he did. Questions were changed for issues of clarification and to increase the likelihood that the interviewees for the study would be providing data that was in line with the interviewer's research interests.

The participants in these interviews were selected through a referral process. In order to maintain a personal distance between the researcher and the participant, individuals were asked to make others aware of the research and then to provide information about the study, the survey website, and how to contact the researcher. Specific phone script and contact information provided to participants were all approved by the Human Subjects Institutional Review Board at Western Michigan University prior to any contact with participants and prior to the collection of any survey data.

Selection of the Population

Questionnaire

The population for this study included school districts in the state of Michigan. Collection of data was conducted through the use of the World Wide Web on the Internet. A secure site was established and an online survey was used to collect

the data. The software program SurveySaid® was made available by Western Michigan University and used to create the survey and collect the data. Each school system was contacted in order to obtain permission to conduct research within the district. When permission was received, an email was distributed to all teachers inviting them to participate in the questionnaire.

Interviews

The population for the interviews was taken from within the same school districts that were included during the survey. For this study, it was important, for the purpose of triangulation, to draw from the experience of the teachers who were coming from the same population of schools and survey respondents. The criteria for individuals who wished to participate in the interview process included being a public school teacher; having some access to technology within his or her school environment either for instructional use, professional support, (e.g., course design, grading, presentation), or both, and having participated in some form of professional development regarding technology use. Because the researcher was seeking specific criteria in order to understand the experience of teachers, the process of purposeful sampling was employed. Purposeful sampling is used to tap into information-rich resources by seeking them out directly. What would be considered a "bias" from a quantitative perspective now becomes a strength in a qualitative study and with a relatively small sample (Patton, 2002, p. 230). The technique was used to select

participants specifically for their experience; therefore, the concern for a random sample technique for selection was not an issue.

Each interview lasted approximately 1 hour and was recorded on audio tape. The recording of the interview was later transcribed by the researcher and printed for analysis using a process of constant comparative analysis (Patton, 1990). This process involves the repeated evaluation of pieces of data into intuited, pre-named lists. Constant comparison of these data (e.g., words, sentences, paragraphs) are arranged into meaningful categories (Grove, 1988). All direct references to individual names and names of the specific schools were removed during the transcription process in order to maintain anonymity.

Data Analysis

The perceptions of teachers regarding five barriers revealed in the literature and previously defined as *time, training and development, involvement, access,* and *support* were investigated by exploring the following research questions:

Hypothesis 1: There is a difference between teachers' perceptions of the importance of time to experiment with technology following professional development and the actual amount of time schools provide to experiment.

Hypothesis 2: There is a difference between teachers' perceptions of the importance of having access to professional development and teachers' perceptions that they actually have access to training and development that schools provide.

Hypothesis 3: There is a difference between teachers' perceptions of the importance of being involved in the design process of professional development and the degree to which teachers perceive they are actually involved in the design process at their schools.

Hypothesis 4: There is a difference between teachers' perceptions of the importance of immediate access to technology following professional development and teachers' perceptions that they actually have immediate access to equipment following technology professional development.

Hypothesis 5: There is a difference between teachers' perceptions of the importance of ongoing technical support and teachers' perception that the level of ongoing support at their schools meets their needs.

The Statistical Package for the Social Sciences (SPSS) was used for statistical analysis in this research. A comparison of means was used to test each of the five hypotheses using an alpha level of .05

The process for evaluation of the interviews was based on grounded theory. In this process, recorded interviews were transcribed with references to the individual participant's name and specific school settings removed. As a part of the research process, the researcher completed the transcription process. This gives the researcher the ability to come to know the interviews better than if the interviews were transcribed by another person (Seidman, 1991). This process allowed the researcher to capture initial ideas as they emerged. Repeatedly playing the tape, with constant comparison to the typed transcription, ensured accurate data transcription. This

process also ensured that data such as pauses, laughing, voice inflection, and frustration were captured and maintained in the transcription. These are an important part of the data that is important to maintain in qualitative research (Mishler, 1986). Transcriptions were read in order to seek consistent and divergent themes through constant comparison. Notes were kept regarding reflections of the researcher as the transcripts were read and thoughts and patterns emerged. As themes were organized and reduced, evidence of support relating to the five barriers were sought for the purpose of triangulation of the survey data. It was important to the researcher to allow the constant comparison method to act as the guide for theme development and not to initially seek direct support for the five initial barriers addressed in the survey. Emergent patterns were identified and categorized and the data were reread again until themes are clearly understood.

CHAPTER IV

ANALYSIS OF THE DATA

Findings of the data analysis for this research are reported in this chapter. Because the methodological approach utilized a multimethodological strategy, it was necessary to report both a qualitative and quantitative evaluation, and finally, to report a synthesis of the two separate components into a single result (Creswell, 2003).

This research was conducted to better understand the experience of K–12 teachers within a public school setting as they sought to integrate computers into their classroom experience. A substantial resource to efficacious integration is thought to be found within the technology professional development process. Chapter II outlined a solid theoretical outline for teachers to support technology integration within the classroom. The essential factors that were previously outlined are defined as *time, training and development, teacher involvement, access to technology,* and *ongoing support.*

Quantitative Analysis

A variety of demographic data was collected to provide a sense of who was responding to the survey and the extent to which they have been involved in the

technology professional development process. Results of the demographic data follow.

Demographic Data

A total of 104 surveys were completed. The majority of respondents were female (72.1 %), came from suburban school districts (76.9%), and responded to ethnic category as white (93.3%). The reported number of years teaching was well stratified, with the largest percentage (21.2%) represented by those teaching in excess of 20 years. Age was also well diversified, with a majority of teachers (27.9%) indicating they were between 46 and 55 years old. An interesting statistic that emerged from the demographic data was the number of respondents from the social studies area (51.7%). Figures for demographic data regarding teacher population and schools are placed in Appendix A.

Teachers were asked to self-report the number of hours they spent engaging in technology professional development within five different domains (see Figure 1). These included training at their school, taking a college course, off-site training, on-line training, and individual training. When asked to report on the number of hours of technology professional development classes they participated in over a year, 35.6% (37) answered 0–3 hours, 34.6% (36) answered 4–7 hours, 8.7% (9) answered 8–15 hours, 9.6% (10) answered 15–25 hours, and 10.6% answered over 25 hours. One participant did not report.

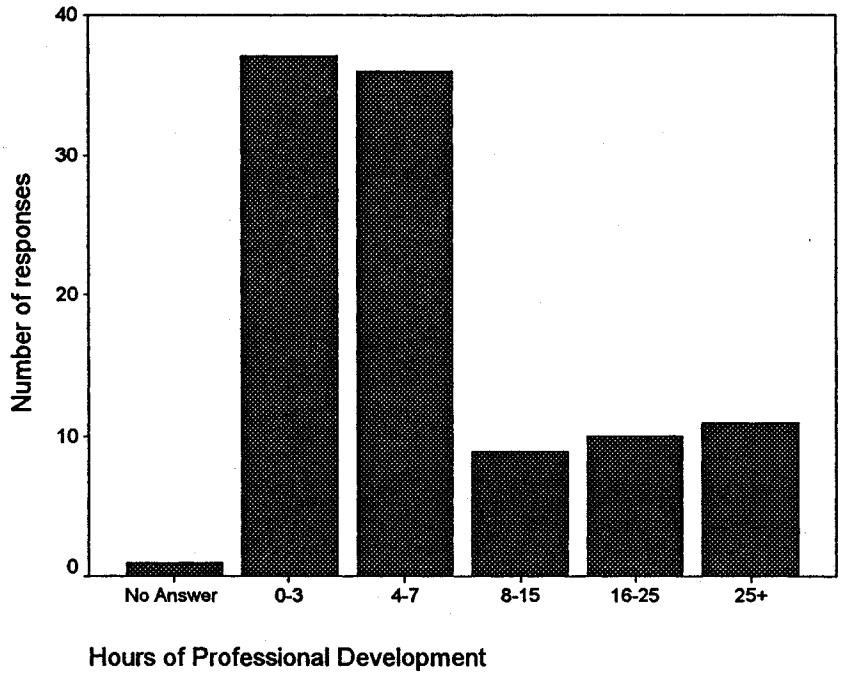

Figure 1. Hours of Professional Development in the Last 12 Months.

For training in their own school, teachers reported that 50% (52) attended from 0–3 hours of technology professional development related activities over the previous 12 months (see Figure 2). The calculated mean was 6.68 hours and the median score was 3.5 hours.

When reporting the hours spent taking a college class, teachers reported 78.8% (82) to have taken 0 hours of technology related professional development over the previous 12 months at a college or university (see Figure 3). The mean number of hours of training taken at postsecondary institutions was 5.8, and the median hours was found to be 0.

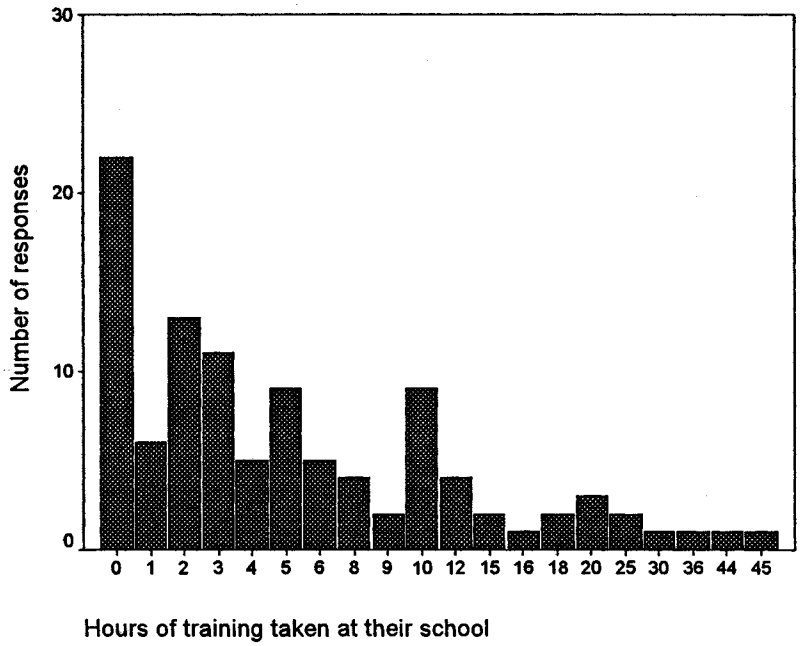

Figure 2. Technology Professional Development Taken at School.

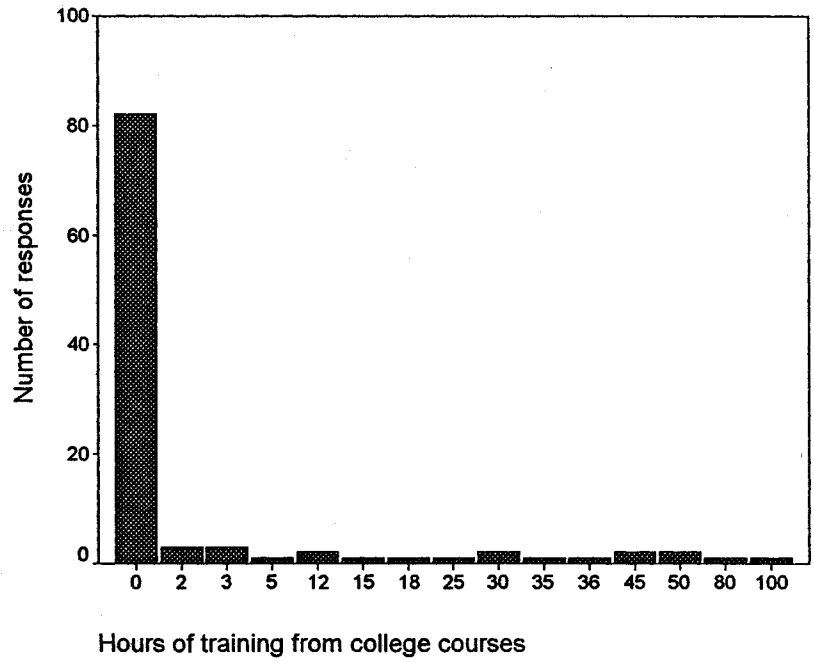

Figure 3. Technology Professional Development Taken at College/University.

Teachers were asked to report how much time they spent attending professional development activities related to technology (see Figure 4). They reported that 88.5% (92) participated in 0 hours of technology related professional development, over the previous 12 months, away from their school, with a mean of .78 hours and a median of 0 hours.

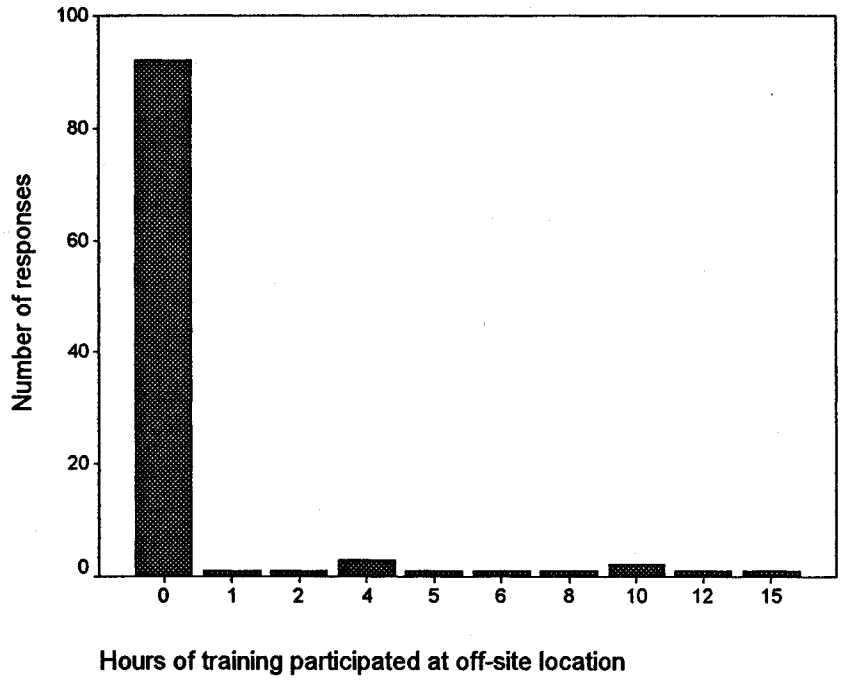

Figure 4. Technology Professional Development Taken Away From School.

The amount of on-line training was another questions presented to teachers. They reported that 92.3% (96) engaged in 0 hours of technology related professional development on-line over the previous 12 months (see Figure 5). The calculated mean for teachers using online resources as a means of professional development was .92 hours and a median of 0 hours.

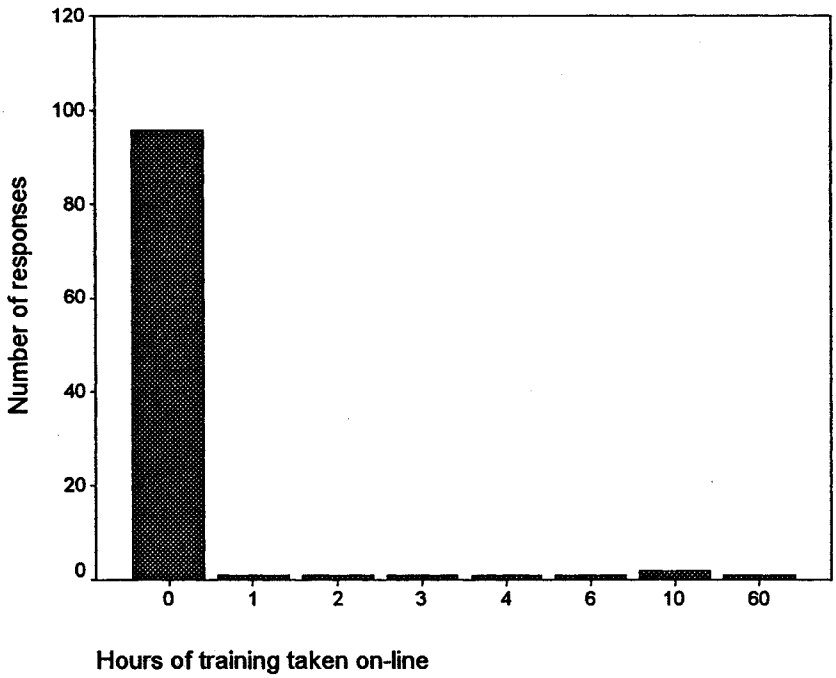

Figure 5. Technology Professional Development Taken On-Line.

The final question related to participation in technology related professional development focused on the number of hours spent on their own to enhance their own technology skills. Teachers reported that that 48.1% (45) spent between 0 and 4 hours over the previous 12 months working to develop their own technology skills (see Figure 6). The mean number of hours per year spent doing individual development was 14.15 hours and the median was 5 hours.

Survey Results

A paired-sample *t* test was used to test each of the five hypothesis for this research. One of the important considerations for this test is the calculated effect size.

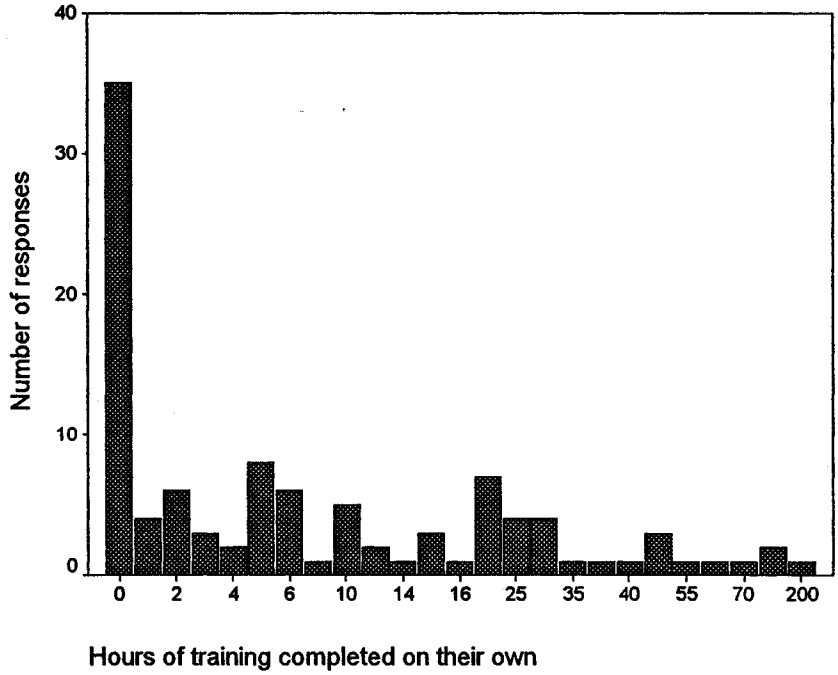

Figure 6. Technology Professional Development Done Individually.

The value of effect size is considered to be an arbitrary consideration (Hinkle et al., 1994; Sheskin, 1997). The values used for this investigation were taken from Cohen (1988) and are established as follows: (a) values that exceed 0 but are no more than .2 are to be considered a small effect, (b) values that exceed .2 but are no more than .5 are to be considered a medium effect, and (c) values that exceed .5 are to be considered a large effect. In all cases, the level of significance, determined prior to the data collection process, was established as $\alpha = .05$. All data analysis was performed using the SPSS. After calculation of the paired-sample *t* test, a performance gap mean was determined by subtracting the mean of teachers' perceptions of actual school practice from the mean of perceptions of importance. These gaps were then rank

ordered to provide a better understanding of issues that were important to teachers by question from the qualitative survey.

Hypothesis 1

There is a difference between teachers' perception of the importance of time to experiment with technology following technology professional development and the actual amount of time to experiment afforded them.

Seven questions from the survey addressed issues related to teachers' perceptions of the importance of having time to experiment with technology following technology professional development, and the extent to which they felt their particular schools addressed this issue. The seven questions relating to teachers' perceptions of the importance of time-related issues were combined and a mean computed by averaging the scores of the seven items. A second mean was calculated combining the same seven questions and the responses to the actual implementation component of the survey. A paired-samples *t* test was conducted between these two variables and found that the perception of the importance of the issues regarding time-related issues ($M = 3.51$, $SD = .67$) was significantly greater than the reported mean of the actual implementation ($M = 2.39$, $SD = .78$), $t(103) = 11.45$, $p = .000$. The magnitude between the difference of the two means, calculated to be $d = 1.13$ is considered to represent a large effect size. Difference between means was calculated to be 1.12 on a 5-point Likert scale. Table 1 presents the results of the paired samples analysis.

Table 1

Paired-Sample *t* Test Comparing Teachers' Perception of the Importance of Time for Practice and Experimentation and Their Schools' Level of Support

	Paired Differences					*t*	*df*	Sig. (2-tailed)
	Mean	Std. Dev.	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 TimePerc-TimeAct	1.1220	.99485	.09803	.9275	1.3164	11.446	102	.000

The paired-sample *t* test reveals a statistically significant difference between the calculated means between teachers' perceptions of importance time for practice and experimentation and their perceptions of actual school support. From the determination of the performance gap mean we find that teachers consider having time to develop technology enhanced instructional activities with other teachers or support staff to be the most significant issue (see Table 2).

Hypothesis 2

There is a difference between teachers' perception of the importance of access to technology professional development and the level of implementation of training and development.

For the second hypothesis, seven questions from the survey addressed issues related to teachers' perceptions of the importance of access to technology professional development, and the extent to which they felt their particular school addressed this issue. The seven questions relating to teachers' perceptions of the importance of access to technology professional development issues were combined

Table 2

Calculated Performance Gap Mean for Questions About Time

Question #	Gap	Question
27	1.30	Time is made available to develop technology enhanced instructional activities with other teachers or support staff
22	1.27	Practicing with newly learned technology skills is a regularly scheduled activity
23	1.25	Time is made available to work with others in order to develop new instructional strategies with technology
28	1.12	Time is made available during the day to practice and experiment with the computer
24	0.99	Finding ways to integrate technology into instruction is a structured process within the school
26	0.90	There are opportunities to rehearse activities using technology prior to using them in the classroom
25	0.45	The work environment is safe to experiment and make mistakes with technology

and a mean computed by averaging the scores of the seven items. A second mean was calculated combining the same seven questions and the responses to the actual implementation component of the survey. A paired-samples *t* test was conducted between these two variables and found that the perception of the importance of the issues regarding access to technology professional development ($M = 3.28$, $SD = .49$) was significantly greater than the reported mean of the actual implementation ($M = 3.04$, $SD = .68$), $t(103) = 3.37$, $p = .001$. The magnitude between the difference of the two means, calculated to be $d = .33$ is considered to represent a medium effect size. Difference between means was calculated to be .24 on a 5-point Likert scale. Table 3 presents the results of the paired samples analysis.

Table 3

Paired-Sample *t* Test Comparing Teachers' Perception of the Importance of Training and Development and Their Schools' Level of Support

	Paired Differences					*t*	*df*	Sig. (2-tailed)
	Mean	Std. Dev.	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1 TNPPerc-TNPAct	.2420	.73204	.07178	.0996	.3844	3.371	103	.001

The paired-sample *t* test reveals a statistically significant difference between the calculated means between teachers' perceptions of importance of training and development and their perceptions of actual school support. From the determination of the performance gap mean we find that teachers are most concerned that professional development activities take place at a time when there is a specific need to learn new skills (see Table 4). An interesting statistic shows that teachers are less concerned (indicated by the negative value in the performance gap) with being grouped together by grade level than what schools actually practice.

Hypothesis 3

There is a difference between teachers' perception of the importance of being involved in the design process and the degree to which teachers are actually involved in the design process.

For the third hypothesis, seven questions from the survey addressed issues related to teachers' perceptions of the importance of being involved in the design

Table 4

Calculated Performance Gap Mean for Questions About Training and Development

Question #	Gap	Question
2	0.84	Technology professional development takes place when teachers have a specific need
7	0.53	Technology professional development is readily available
6	0.22	Technology professional development groups teachers together by the same teaching discipline
1	0.19	The best location to hold technology professional development activities is at the school building
4	0.08	Technology professional development is a mandatory activity for all teachers
3	0.01	Technology professional development activities should be held during the day
5	–0.16	Technology professional development groups teachers together by the same grade level

process for technology professional development, and the extent to which they felt their particular school addressed this issue. The seven questions relating to teachers perceptions of the importance of being involved in the design process for technology professional development issues were combined and a mean computed by averaging the scores of the seven items. A second mean was calculated combining the same seven questions and the responses to the actual implementation component of the survey. A paired-samples *t* test was conducted between these two variables and found that the perception of the importance of the issues regarding involvement in the design of technology professional development ($M = 3.60$, $SD = .49$) was significantly greater than the reported mean of the actual implementation ($M = 2.63$, $SD = .81$), $t(102) = 11.20$, $p = .000$. The magnitude between the difference of the two means,

calculated to be $d = 1.10$, is considered to represent a large effect size. Difference between means was calculated to be .97 on a 5-point Likert scale. Table 5 presents the results of the paired samples analysis.

Table 5

Paired-Sample *t* Test Comparing Teachers' Perception of the Importance of Involvement in Technology Professional Development Design and Their Schools' Level of Support

	Paired Differences							
				95% Confidence Interval of the Difference				
	Mean	Std. Dev.	Std. Error Mean	Lower	Upper	*t*	*df*	Sig. (2-tailed)
Pair 1 PartPerc-PartAct	.9699	.87862	.08657	.7982	1.1417	11.204	102	.000

The paired-sample *t* test reveals a statistically significant difference between the calculated means between teachers' perceptions of importance of involvement in the design of professional development and their perceptions of actual school support. From the determination of the performance gap mean we find that the greatest concern for teachers in the area of involvement is whether teachers are directly involved in the design process (see Table 6).

Hypothesis 4

There is a difference between teachers' perception of the importance of immediate access to technology following technology professional development and the degree to which teachers actually have access to equipment.

Table 6

Calculated Performance Gap Mean for Questions About Involvement

Question #	Gap	Question
20	1.06	Teachers are included when designing professional development activities
15	0.97	Technology professional development is designed so I can create something to be used directly in my classroom
17	0.95	Integrating computers into the school is part of a school-wide strategic plan with input from teachers
19	0.95	Teachers determine when the training takes place (time of day)
16	0.94	Technology professional development addresses issues that are directly relevant to instructional needs
18	0.86	Teachers are actively involved in determining the length of the training activity
21	0.84	Technology professional development links directly to instruction

For the fourth hypothesis, seven questions from the survey addressed issues related to teachers' perceptions of the importance of immediate access to technology immediately following technology professional development, and the extent to which they felt their particular schools addressed this issue. The seven questions relating to teachers' perceptions of the importance of immediate access to technology immediately following technology professional were combined and a mean computed by averaging the scores of the seven items. A second mean was calculated combining the same seven questions and the responses to the actual implementation component of the survey. A paired-samples *t* test was conducted between these two variables and found that the perception of the importance of having immediate access to similar technology ($M = 4.16$, $SD = .59$) was significantly greater than the reported mean of

the actual implementation ($M = 3.82$, $SD = .78$), $t(102) = 4.18$, $p = .000$. The magnitude between the difference of the two means, calculated to be $d = .41$, is considered to represent a medium effect size. Difference between means was calculated to be .339 on a 5-point Likert scale. Table 7 presents the results of the paired samples analysis.

Table 7

Paired-Sample *t* Test Comparing Teachers' Perception of the Importance of Technology Availability Following Technology Professional Development and Their Schools' Level of Support

	Paired Differences							
				95% Confidence Interval of the Difference				
	Mean	Std. Dev.	Std. Error Mean	Lower	Upper	*t*	*df*	Sig. (2-tailed)
Pair 1 AvalPerc-AvalAct	.3389	.82380	.08117	.1779	.4999	4.175	102	.000

The paired-sample *t* test reveals a statistically significant difference between the calculated means between teachers' perceptions of importance of technology availability and their perceptions of actual school support. From the determination of the performance gap mean we find that the greatest concern for teachers in the area of availability is centered around whether computer software is installed and running following the attendance of professional development activities (see Table 8).

Table 8

Calculated Performance Gap Mean for Questions About Availability

Question #	Gap	Question
32	0.79	Software is installed and running properly when training activities are completed
34	0.31	Computers are available for students to use on a regular basis
29	0.29	The hardware used during the technology professional development is similar to what I use in my classroom
30	0.27	The software used during the technology professional development is exactly the same as what I use in my classroom
33	0.16	Computers are available on a consistent basis for me to use as part of classroom instruction
31	0.15	The computers are in place when training activities are completed
35	–0.02	Computers are readily accessible to use following any technology professional development

Hypothesis 5

There is a difference between teachers' perception of the importance of ongoing technical support and the level at which schools implement ongoing technical support for teachers.

For the final hypothesis, seven questions from the survey addressed issues related to teachers' perceptions of the importance of ongoing support following technology professional development, and the extent to which they felt their particular school addressed this issue. The seven questions relating to teachers perceptions of the importance of ongoing support following technology professional development were combined and a mean computed by averaging the scores of the seven items. A

second mean was calculated combining the same seven questions and the responses to the actual implementation component of the survey. A paired-samples *t* test was conducted between these two variables and found that the perception of the importance of the issues regarding having access to technical support ($M = 3.96$, $SD = .55$) was significantly greater than the reported mean of the actual implementation ($M = 3.10$, $SD = .84$), $t(102) = 9.29$, $p = .000$. The magnitude between the difference of the two means, calculated to be $d = .92$, is considered to represent a large effect size. Difference between means was calculated to be .85 on a 5-point Likert scale. Table 9 presents the results of the paired samples analysis.

Table 9

Paired-Sample *t* Test Comparing Teachers' Perception of the Importance of Access to Support and Their Schools' Level of Support

	Paired Differences							
				95% Confidence Interval of the Difference				
	Mean	Std. Dev.	Std. Error Mean	Lower	Upper	*t*	*df*	Sig. (2-tailed)
Pair 1 SuptPerc-SuptAct	.8539	.93331	.09196	.6715	1.0363	9.285	102	.000

The paired-sample *t* test reveals a statistically significant difference between the calculated means between teachers' perceptions of importance of access to support and their perceptions of actual school support. From the determination of the performance gap mean we find that the greatest concern for teachers in the area of support is centered around whether computer maintenance issues are quickly addressed (see Table 10).

Table 10

Calculated Performance Gap Mean for Questions About Support

Question #	Gap	Question
12	1.08	Computer maintenance is quickly addressed when the system does not work
10	0.96	Technology support staff are available when I need them
13	0.96	Technology Support is quickly accessible for both hardware and software related issues
14	0.80	Curriculum support is an important part of integrating technology into the classroom
11	0.76	The existence of a peer support group to share technology ideas and help
9	0.66	Technology support staff understand teaching and curriculum concerns
8	0.61	Technology staff are directly available to support my integration efforts

The full list of questions were rank ordered by performance gap means to find the issues that teachers considered to be the most important (see Table 11). From the results of this analysis we find that the overwhelming concern for teachers when identifying barriers to using technology following professional development is the lack of time for practice and experimentation. Five of the seven questions related to issues of time were found in the top seven responses.

Additional consideration for the reliability of the survey questions was addressed by calculating a Cronbach's alpha coefficient. The alpha coefficient was calculated for each of the categories for both teachers' perceptions of importance, and the extent to which they believed schools addressed the particular issue. From the results of the reliability testing, it is clear that, even though a somewhat moderate

Table 11

Calculated Performance Gap Mean for the 10 Most Important Issues for Teachers

Question #	Gap	Question
27	1.30	Time is made available to develop technology enhanced instructional activities with other teachers or support staff
22	1.27	Practicing with newly learned technology skills is a regularly scheduled activity
23	1.25	Time is made available to work with others in order to develop new instructional strategies with technology
28	1.12	Time is made available during the day to practice and experiment with the computer
12	1.08	Computer maintenance is quickly addressed when the system does not work
20	1.06	Teachers are included when designing professional development activities
24	0.99	Finding ways to integrate technology into instruction is a structured process within the school
15	0.97	Technology professional development is designed so I can create something to be used directly in my classroom
10	0.96	Technology support staff are available when I need them
13	0.96	Technology support is quickly accessible for both hardware and software related issues

alpha coefficient is found with regard to teachers' perceptions of training and development questions, overall reliability for this survey instrument is strong. The results of the reliability are reported in Table 12.

Qualitative Analysis

Data Transcription

Each interview lasted approximately 1 hour and was recorded on audio tape by the researcher. After the completion of each interview, the researcher performed

Table 12

Alpha Coefficient Results of Instrument Reliability

	Perceptions	Actual Practice
Training and Development	.4895	.7579
Support	.7816	.8817
Involvement	.7219	.8738
Time	.8692	.8697
Availability	.8213	.8634

the transcription process. The transcription process was an important part of the initial analysis process. The actual interview followed a more structured process where the 10 questions were specifically outlined so that the verbal interaction was limited between the researcher and the participant. Care was taken to listen for critical issues that may have required clarification, yet remain cognizant of leading follow-up questions or even specific gestures, body movements, or facial—all of which can serve to influence the participant (Mishler, 1986). It also ensured that important data were not lost, such as voice inflection, long pauses, laughter, nervousness, etc., that are important to faithfully representing what the participant had to say. What may seem like unimportant sounds, utterances, and expressions can be important to the study (Riessman, 1993). Seidman (1991) suggested that "interviewers who transcribe their own tapes come to know their interviews better" (p. 98). The qualitative component of this study was based on the use of interviews with methodological use of grounded theory for analysis. The interviews were used to triangulate the findings

of the survey as defined by the concurrent triangulated method defined by Creswell (2003). The 10 questions that each participant was asked were designed to learn as much as possible about their own experiences using technology and professional development. At the analysis phase, the transcriptions were repeatedly analyzed in order to determine overall themes about perceptions, not to do a comparative analysis of the 10 individual questions.

Learning About the Participants

The qualitative component of this research was all about the participants. There are various ways by which to refer to individuals involved in research and the term *participants* was not selected without careful consideration. The participants were generous for taking the time to sit with me and tell me a little bit about their life as a teacher and the challenges and rewards they encounter when exercising their craft. I will introduce them now, using pseudonyms for the sake of maintaining confidentiality. In the introductions we will learn more about their history and life experiences as well as their technology experience. Understanding the background of the participants helps situate them within the context of the study.

Mary

Mary had a less-than-desirable experience while attending high school due to her dislike for rote memorization and the requirement to sit still and be silent until spoken to. After attending a few different universities, she majored in education and

graduated. Not being able to obtain a teaching position, she took a position in the private sector. She was active in volunteer work at the time and, after several years in the private sector, she returned to education. She had to recertify as a teacher and then took a part-time teaching position. Her enthusiasm grew as a teacher, and also as somebody who embraced technology—how it could be used for herself and for her students. She was motivated to bring technology into the class whenever she could and was moved to do so as a means of improving the learning environment for her students. She made it a goal to give her students the ability to use search engines on the Internet so that they could find useful information and also be discriminating in their selections of what was appropriate and what was not appropriate while on-line.

The excitement of teaching did not retreat and she felt the need to move to a full-time position. She was fortunate to find a position in a nearby school system and has been there now for 8 years. She persisted in her drive to integrate the use of the Internet as much as possible as a tool for research in various activities including global studies, history competitions, or checking what the latest is on CNN. She is pleased so far with what she has brought to her profession, enjoys the challenge, and, as she states, "I've always loved the kids, I like the classroom, I thought there needed to be a change, I thought we needed real world experience."

Cassandra

Cassandra was just finishing her first year of teaching when I had the chance to speak with her. She completed an associate of arts degree from a community

college in Michigan before entering an EI (emotionally impaired) program at a state university. She later transferred to a smaller private college and completed her degree from their LD (learning disabled) program. She was fortunate enough to find a position teaching in a fourth and fifth grade, self-contained classroom in a school back in her home town. Most of her students are severely disabled including LD, EI, and POHI (physically or otherwise health impaired).

Her technology background was fairly limited with a single computer class in high school and the use of a typewriter during college. She has done quite a bit using prep time as a substitute to go to computer labs and learn what she could on her own.

Emily

Emily graduated from a small private college in Michigan in 1994 with a degree in English and biology and secondary education. Her first teaching position was awarded three days before the start of school and she recalled "being thrown right in." She is now in her 10th year at the same school and exudes a quality of confidence in her work. She enjoys working technology into her instructional practice in the areas of English and biology. She received her masters of arts and science in education degree in 1998 and also teaches college courses as an adjunct instructor.

She is very comfortable within a technology environment and enjoys constantly experimenting with them. Most of her curriculum is generated and modified on a computer. She feels these are an important part of her instructional process.

Alan

Alan earned a bachelors degree from a public Michigan university and taught in a smaller school system in Michigan for 7 years. He left teaching to pursue other interests in the private sector, but due to the declining manufacturing market in the early 80s, returned to teaching for another 5 years at the same school. He expressed a degree of satisfaction for having pursued other interests and was reinvigorated to return to the classroom. At the time, he was teaching a variety of classes, including chemistry and physics. After 5 years passed, he found an opportunity to move to a different, larger school teaching physics and has been there for 15 years. During his tenure in the private sector, he admitted to being bitten by the "computer bug" when the PCs were first becoming available, starting out with a Commodore 64. He is capable of doing some programming but admits, "I'm not a programmer kind of guy . . . getting into programming gives me a headache." He moved up through the computer ranks going from the commodore to an Apple II and then Macintosh computers. He currently utilizes Windows®-based computers at school.

He completed a masters degree in educational technology from a public Michigan university in 1992 and suggested that, with his extensive background, he felt it was more like getting credit for what he already knew. He has considered the role of technology coordinator for the school, but because "mostly, technology coordinators are budget people and . . . network gurus keeping machines running" prefers to stay away from the position. In a technology coordinator role, he would see

himself more as a coordinator for instructional purposes and support instead of computer support.

Michael

Michael pursued the career of teaching as a debt to a teacher who had inspired him. He stated, "A teacher stopped me from doing some very stupid things in high school," and his commitment to teaching is without question. He graduated from a public Michigan college in 1983 with a B.A. in political science and a minor in history, but was unable to find work upon graduation. He was told there were no teaching jobs available, and that he should not even bother looking. He met his wife a year after graduation and they moved out of Michigan. They returned to Michigan soon after and he began attending a public Michigan university in their teaching degree program. Due to problems with classes and scheduling, he transferred to another nearby university to pursue and education program in business. After finishing this program, he was a substitute teacher for a full year in very small school which is exactly what he enjoyed, making the decision to find work teaching in a small, rural school. His first full-time experience was at a charter school, which was later absorbed by a larger urban system and it became part of their alternative education program. After 3½ years, he left to take a full-time position at the school in which he is currently employed. The position was to teach web design and business classes and to become the career prep coordinator. He completed his master's degree in educational technology in 1999. He is currently finishing his 9th year as a teacher.

He uses technology as much as he can in his instructional process and is very talented and motivated when it comes to computers and technology, both in the classroom and at home. Part of his instructional process involves his students utilizing the Internet for research and for a variety of interesting sites to do things such as personality testing and leadership evaluation.

Jorge

Jorge came to this country from the Dominican Republic. Just before he finished high school, there was a revolution and the dictator, Rafael Trujillo, was assassinated. One to two university students were killed each day, so his dream of becoming an engineer ended. He attended college in Puerto Rico instead. After finishing there, he wanted to further his education so he came to New York City and worked. He worked there and then in Chicago to save additional money so he could attend a private university in Michigan. He completed his master's degree in history and also met his wife during this time. It was difficult trying to find a teaching position in 1979, but he found a position teaching as a substitute because he was bilingual. Jorge later found a full-time position as a paraprofessional in an ESL (English as a second language) program in a public school. While there, he completed a master's degree in bilingual education. This program was cut in 1997, so he took a position in another public school system as a Spanish teacher, but due to budgets, he lost his position by the end of the year. It was at that time that he found an opening for an ESL teacher at the school where he currently teaches, and he is completing his

7th year at this school. His classes are composed of very diverse populations of students, including students from Bosnia, Albania, Croatia, Hispanic/Latino countries, Korea, Vietnam, Sudan, Somalia, and China.

Much of his computer knowledge comes from playing and experimenting with them. "You learn more by doing that than by taking a course at college . . . really." He uses the computer in his class for exercises and drills for his students and is comfortable installing his own software for them to use. It is comfortable for him to be working on his computer, and you can find him days, nights, and weekends sitting with them. With a laugh he confided, "Sometimes for some reason I can't sleep, I go to my computer and sit there until I get sleepy."

Research Themes

Time

The first research theme, *time*, considers the amount of time a teacher has to work with a computer. This includes the ability to openly experiment and practice in order to reinforce their abilities, and to become comfortable with the equipment. A barrier to successful technology integration would be found in a lack of time available to practice and experiment. The participants who were interviewed revealed a level of commitment to an investment of time, but none of it seems to come from a commitment of the schools as a formal part of a strategic plan for technology implementation.

For some, the use of time was found to be an individual choice just from the enjoyment of working with computers. For others, it seems to have come more from a sense of survival. Looking foolish in front of students and struggling with technology is a concern for teachers when using technology (OTA, 1995; Schrum, 1999).

Jorge clearly found the investigation of computer technology to be a rewarding experience. He spoke of how he loved to work with computers starting with his first Franklin computer, then to two different Apple //e computers, and finally to his current Windows®-based system at home and in his classroom. This investment of time finds its reward when Jorge speaks of using technology in his classroom. The array of programs that he uses for drilling math, science, and vocabulary are often installed and maintained by him. He considers the use of technology to be an integral part of his craft stating:

> I'm a big fan of computers because they can enhance the learning process. And I want to say that 70 to 80% of my students have computers at home. I know because they catch me on the Internet and want to say hello.

Jorge has also taken the time to create and publish a small web page for the benefit of his students so they may check in with homework assignments and send email, which, as ESL (English as a second language) students, Jorge encourages because he sees this as a part of their learning process by practicing the language.

Similarly, Michael revealed that he has spent a substantial amount of time practicing with computer. He used a Commodore 64 and then worked up to an Apple II, a few Apple Macintoshes, and now a Windows®-based PC which he emphasizes

he was "forced to get." Michael has a clear sense of the investment of his personal time and how it has benefited him when it comes to using computers to his advantage. He spoke of the development of handouts, which at one point had to be done on dittos where you had to "scrape the stuff off the back" in order to make changes or simply go back and start again with a new ditto.

Cassandra reflected upon the limited time coupled with limited technology professional development. When asked how she proceeds to seek support when she has an idea to use technology but doesn't have the skills necessary, she laughed. Suggesting that there really was not much training available on using a computer, Cassandra said that "it was basically, a guess, do your best." In order to try to find the time necessary, Cassandra would spend time "after school, going through everything." With a bit more frustration and a slight, wry laugh she continued by saying:

> I either keep guessing or try to get a hold of the teachers that taught in the classroom before I did, that might be more familiar with the programs, um, I try to call the technology department to see if they can't come within the next couple days . . .

Other time is informally found within the daytime schedule by using the computers "when the kids aren't on the computers to see if we can't get some things figured out." In this situation, there is creativity in finding time to experiment with technology, but the time used is not as much for practice and experimentation as much as it is for trying to find out how to make things work in lieu of available technology professional development or support.

Time also becomes a consideration when participants discuss trying to apply what has been presented during technology professional development. Emily attended a session where teachers were doubled-up in a room of 40 people trying to lead them en mass through a step-by-step tutorial. She spoke of how excited she was to return and work with Adobe PhotoShop but did nothing with it. The step-by-step environment did nothing to provide any sustained knowledge, and Emily was faced with trying to find the time after the training failed her. "But, once again, it's, do I have the time to sit down for three hours with [a colleague]? That sort of thing." Not only was the time spent attending a session in which it was clear to the teacher that her goals would not be met, but then she was faced with the same situation prior to attending the session. She was required to find the time on her own to gain the skills necessary to use the computer to meet her own needs. Emily, like some of the other participants, dedicates much of her personal time to learning about the computer and software applications. Her technology experience is more readily guided by another support person who is available at rather short notice. This support comes from another teacher who is able to provide insights from instructional perspective.

In a most succinct reply when asked about what it was like to try to apply what has been presented during technology professional development, Alan replied simply, "You don't have time to do it. That's the short answer." In a further elaboration he continued by saying:

> But time is, the time it requires is unbelievable, and I, that's an issue I have with using computers for instruction and that's that, most of the instruction that I envision or see with computers is often cursory compared to the power that's available in the machine, but to utilize the power that's available in the

machine takes so much background, effort, and work and revision that most people simply won't do it.

Training and Development

The consideration for training and development centers around the availability of technology professional development at a time when teachers are ready to learn. It is important that training and development meets the needs of the teachers. It should provide an experience that meets individual needs for learning, is interactive and problem centered, and allows for direct application. This learning experience must also be designed to present the teachers with an experience which situates them with computers and software similar to the environment with which they will be familiar when they get return to their classrooms.

It was interesting to learn about the training and development experiences from each of the participants. When asked to describe the most positive experiences with technology professional development they responded anywhere from thinking carefully about what that experience may have been before recalling it, suggesting that it was a very tough question and that that would be a rare experience, and confessing that there was little positive to draw from. Conversely, when they were asked about technology professional development that fell short of their expectations, the response was much more immediate and the willingness to share was apparent. These differences will be revealed below.

When attending training that had a positive impact with the participant, the enthusiasm was apparent. Relating her experience about a particular session that was

very positive, Cassandra sat forward and was visibly happy about the experience. The situation involved a special education student who was nonverbal and utilized a machine called a Vantage to help the student speak and put ideas across. This particular machine came to the school near the end of the school year and training was made available somewhat spontaneously on the day before the end of the school year. It was specific to the application and involved a small group of teachers who worked specifically with this student. They were allowed to experiment and ask questions during this process and then attempted to apply what they learned the next day. The thrill for the teachers, as relayed by the participant, was to suddenly communicate with this student.

> I went to the training the day before; we were able to hook it up to my computer where I could ask him questions and he could answer it, and he could print it off and do complete individual, and, um, it was amazing to see how, I mean, I don't think he thought he could be as independent as he was. So, he could tell us what he ate for dinner, he could tell us how he felt, he could tell us his whole name. And that, it was just amazing, and this next year will just be a complete eye opening experience, to let us know what's really in there, because he has a way to express himself. That training was the most valuable training I've ever had as far as the technology department.

For Cassandra, there was a clear goal in mind when attending the training session and she was able to apply techniques immediately. The results and expectation for success were realized in seeing positive results from her student.

Expectations for successful learning and application can be found in adult learning literature suggesting that the environment should, among other things, be problem centered and focus on an immediacy of purpose (Cross, 1981; Knowles, 1990). Mary had just recently participated in a technology professional development

session that was positive for her. She recalled that it was a hands-on experience, indicating that she had her own computer to work with. The experience provided for time to experiment and create by the participants and the instructor; from the perspective of Mary, the trainer had "extreme patience" and had alternative approaches to helping individuals learn about how to use the software. The combination of the material and strategies of the instructor made the experience fun and challenging due to necessary problem-solving for project development. There was much agreement between participants when it came to the person doing the training. When asked about what made technology professional development a positive experience, there was general agreement that the trainer was an instrumental piece. The agreement was that this person must be knowledgeable, adaptable, understand teaching and how the content applies, enthusiastic, a good presenter, able to answer questions, and clearly in touch with those attending.

Training and development that did not meet expectations was a much easier topic to find stories. Throughout the process of constant comparative analysis, a series of themes within the context of training and development emerged. These themes were: (a) size of the session, (b) direct hands-on use, (c) input into the design or content, (d) direct application to their instructional needs, (e) working with people with similar skill levels, and (f) the skill of the presenter. The use of the word *frustration* was pervasive.

Size of the Session. The participants were keenly aware of attending sessions where the number of attendees was a barrier to the process. There was a feeling of

disconnection from the activities and a disassociation from whatever the goal of the training might have been. Participants spoke of sitting in rooms that had 40 or 50 people and a single presenter trying to guide them all through an activity from the front of the room on a single projection screen. Those attending have a desire to learn but come away frustrated. Concerning being in a room with 50 other teachers, Cassandra recalled:

> We could hardly ask any questions, and because there were so many people, that, so many people compared to one instructor. There's no way you could get through everything, and, I mean, you walked out of there thinking there's no way I'm going to be able to do this by myself. There's way too many questions I have.

In a more extreme example, Michael talked about a session with nearly 300 teachers sitting in a room in a lecture-based presentation of technology professional development. The presenter used PowerPoint to present computer concepts on a projector at the front of the room, while the attendees followed along with handouts of the presentation.

Direct Hands-on Use. The experience of large groups has a direct impact on the attendees' ability to use equipment to get some kind of hands-on experience. In the larger groups where 40 to 50 people are attending, the common concern appears to be to place multiple attendees on a single computer. This creates a stressful and frustrating environment when attendees have a specific need for application. When Cassandra was sent to attend a 1-day session intended to teach teachers about a literacy program to be used within their schools, the expectation of their schools was that teachers were proficient with this program when they returned with specific

curriculum they had to meet. With a rigorous pace "it could have easily been a 3-day in-service . . . but they wanted to cram everything together because of the cost" and limited hands-on experience, attendance proved to be frustrating. "I would guess about 50 people in a room with one instructor and we're all sharing computers because there wasn't enough computers."

When Michael spoke of the computer training he attended with nearly 300 people, I was surprise to learn that those attending merely sat at tables listening to a presenter talk about the technology while displaying PowerPoint slides on a projection screen. The attendees were given a handout of the slides that were being presented so that they could follow along. Not only did this create a frustrating environment for Michael (who was so far back that he could not even see the screen at the front of the room), but the slides were general overviews of technology and provided nothing that could be brought back to the classroom for experimentation or application.

> Their materials weren't interesting; there were no real-world application. So it was, "Okay, you've given me all this technological information but who cares, where do I use it?" . . . We were sitting at a desk with a PowerPoint presentation that showed us all of the screens that they were using and we each had one photocopied. We didn't even have colored. We had no applications at all. . . .We were watching somebody else, and we were flipping through PowerPoint presentation notes and the person presenting it didn't look to the audience, and had problems himself navigating what they were going through [frustration, tension in voice]. I was just . . . why am I here? [frustration, laughs]

Design of the Session. When attending these larger sessions, the design of the presentation typically takes on the role of leading people through a series of step-by-

step exercises. In these sessions there seemed to be very little (if any) advantage for anybody in attendance. For those who were experienced with technology, the sessions provided no valuable information that they could apply when they returned to the classroom. There were cognizant of the fact that they were just following along and pushing a button because that was the next step. And even for them, because of the number of people in the session, if they were not able to see or hear what the presenter did, and they missed a step, they too were lost and not able to continue unless they managed to get the attention of the presenter. Emily recalls sitting through a session as she was merely following steps:

> Then you just go through these steps. You really didn't get any, like, if this happens go here. It was just very sequential and, you know, no trouble shooting or anything like that which I think is a big thing because, heck, you press one wrong button and you . . . you ruin your material, or you didn't do the thing you were supposed to and maybe you can't unto it because you've already done two or three things on top of that, and how do you get back . . .

Later she elaborated further by saying, "You pressed the button, you did it. Then you waited for the people around you who had no clue what the guy was talking about."

Alan was clearly frustrated around the issue of scripted, step-by-step training sessions when he said, "but I think we miss the details, all the 'Do this first, this second, this third' for the overall idea of 'What did that accomplish?'" When asked if he could design the perfect technology professional development experience, one of the primary considerations for him was that the number of people in attendance would not exceed 10 and, in fact, "10 might be pushing it. Having more than 10 you might as well kiss it goodbye."

When asked about his best experience attending technology professional development, Michael referenced the skill of the presenter and that the process was important. He was specifically critical of the linear step-by-step method: "So, what makes it positive? To a great extent it's the person presenting it making sure that they are presenting it in a manner that's not 'Here you go dummy, this is what you do next.'"

Direct Application to Their Instructional Needs. Whether attendance at a technology professional development session is mandatory or if it is selected by the attendee individually, the expectation of the attendee is that the experience will be valuable. There was clear frustration revealed by participants when attending training and development sessions where they quickly realized that this simple goal would not be met. Part of the difficulty was found to be defined by the delivery method mentioned previously, where attendees are led through a series of sequential steps to create a one-size-fits-all project. This not only narrowly defined what participants would do during their visit, but also mitigated deeper learning of materials by removing any problem-solving throughout the process. In a session where they began this step-by-step deliver system, Alan quickly came to the conclusion that his attendance would not meet his needs and the frustration was evident. He relates "It was information that I could have found on my own by trying something that would take, and I'm not kidding here, 30 seconds." When Michael was attending the session with 300 other participants for computer training by sitting with printouts following along with the presenter, he was amazed to hear concepts explained to him that

included defining what a mouse and a keyboard was. With no sense of how this will aid in his instructional process, and critical of the presenter with apparently limited skills, Michael mentioned, "They have no idea that they should dump their script and ask the people what they want to know." While the possibility of dropping their script in front of 300 people and trying to quickly get a sense of what each person would like would be an impossible task, the concern for applicability was apparent.

Working With People With Similar Skill Levels. Of the 6 participants in this study, 5 of the 6 were comfortable working in a computer environment. In each of their stories, they revealed a sense of frustration when attending technology professional development where there was a large variation in the computer skill level of the attendees. With much of their experience situated in a step-by-step environment, presenters are trying to lead groups of people through a computer program together. This process was slowed by individuals who were unfamiliar with computers and required the attention of the presenter to help them out. Here again, the frustration was evident from her exasperated tone of voice as Emily recalled, "You waited and waited and you waited until the next step," after she had pressed her button and waited for those who couldn't do it correctly.

Jorge attended a mandatory session where he had to attend either during the summer, or during the academic year at the end of the day. Because he didn't want to spend time after school, he attended the summer session. During this session, one of the exercises the teacher had the participants engage in was to play solitaire for the purpose of building skills of how to use a mouse. This experience alone must have

been difficult for Jorge, who holds a master's degree in educational technology and has many years of computer experience. He specifically described the frustration of the vast disparity between the skill levels of the participants. It was not intended as a pejorative statement, but more of an appreciation of the difficulty of the experience of all participants involved.

> They couldn't bring themselves, to bring the mouse to the card and drag it to wherever they want. So they couldn't use the mouse. And I was thinking "Boy, some of us need a lot to learn," you really have to do the survey, because you cannot have somebody that is fairly knowledgeable about computers with someone who doesn't know how to use the mouse, because that will be frustrating for both groups.

It is difficult to imagine the experience of a teacher with master's degree in technology education being sent to technology professional development that seeks to guide teachers through the process of how to use a mouse, especially for Jorge, to be sitting in with other participants where this exercise alone was a difficult task, requiring time for others to practice before they could move on.

Skill of the Presenter. The skill of the presenter was a priority when it came to understanding what helped make technology professional development a meaningful experience. Participants responded well to presenters who allowed for experimentation as part of the session. Typically in an environment with small numbers of participants, there was enthusiasm for having time to create their own projects based on loose guidelines. Working through their own projects, participants spoke of enjoying the creative process and having a presenter available to help with specific problems as they came up. In this more creative environment, you could "go

out and do your own thing, and then go to him . . . if you didn't know what to do," as related by Emily. She also revealed that a great deal was learned from this session, whereas when she attended a previous tutorial-led session following along step-by-step, "I didn't keep anything from the other workshop." Alan referred to somebody who "can cover kind of that gamut," sensing when people are okay and can be left to their own abilities, while others may require more immediate attention.

Teacher Involvement

Involvement in the process for designing technology professional development gives an opportunity for teachers to create a learning involvement which incorporates topics important to them. Their intention for attending technology professional development is to take newly acquired information and apply it to their teaching experience. When a teacher had an opportunity to have some control over the content and design of their technology learning experience, the appreciation of the experience was evident. At Emily's school they were using specific software for student activities and record keeping which all teachers needed to use. When the software was upgraded, they needed to learn about the new features and how to work with the software changes. The process involved getting together in a staff meeting to talk about the things that were important to them and also to hear about the new features. "Basically it's just asking everybody what they want and because everybody's . . . they have a vested interest in it." The technology professional development consisted of getting together and playing with the new features and feeding ideas back and forth

between teachers as they experimented. They knew what to expect and what their expectations were when they got together because they had specified the criteria up front. They had their own computer to work with, and the opportunity to experiment. Emily was pleased with the informal interaction with other teachers, talking about features and options that were available and how others were using them.

Technology professional development which did not involve any input from teachers and did not meet their needs clearly was a touchy issue. Alan was obviously perturbed when he recalled attending technology professional development that was grossly beneath his capability. Sitting and having concepts presented in a seminar that he could have discovered himself in 30 seconds without question failed to meet his needs. Direct input into the design of the session and clear communication regarding what was important to him as a learner was overlooked.

Instead of designing the content to fit their needs, teachers are sometimes forced to take the content prepared by somebody else and try to fit it to their own experience. It was necessary for Jorge to reconfigure what he learned when attending technology professional development because it did not directly address his concerns teaching in an English as a second language classroom. Even though he is a self-proclaimed computer savvy individual, he found the process of making things relevant to his classroom difficult at times.

> I have gone, I have attended a lot of in-services on technology. I've gone almost every year to the IPD conference that the MEA puts out every year. A lot of time you cannot apply the content of that workshop the same way they present it to you. You cannot apply that to your classroom, the same way, but you can certainly adopt them.

Access to Technology

Access to technology takes into account teachers' ability to immediately apply what they have learned from attending technology professional development by having access to technology when they return to their classroom. The question of whether they have the time to do so has already been considered previously and appears to be worthy of concern. Access considers whether the teacher has immediate use of the tools used in technology professional development. In a wonderful example of how this can be a powerful experience, Cassandra related her experience using the computer program that would allow her, and other teachers, to reach a nonverbal student in a special education program at her school. The Vantage communication device is a machine that attaches to a computer and allows nonverbal individuals to utilize a special touch screen in order to access core vocabulary. It is specialized equipment, and Cassandra was able to use this equipment, and apply what she had learned, the day after the training took place. Immediate access and application allowed for a very rewarding experience for her and her student.

Not only was it important that the computer technology was available and working properly, but also that the hardware or software used during technology professional development did not vary and that it was similar to the teacher's own environment. It was frustrating to attend a session where presenters explained that what participants see and do during that session may look or work differently in their own experience. Describing some of his "turn-offs," Alan related things he definitely doesn't want to hear when he attends technology professional development. He was

very wary of hearing things such as "yours isn't going to be quite like this; this is a different version," or as he put it, "The one-size-fits-all mentality." These are things that cause frustration for Alan, and it is important to consider that he is an individual very comfortable and competent with computers and technology in general.

Ongoing Support

When trying to understand what the experience of support was like for teachers, I asked what it was like to be sitting in their classroom at a time when they were trying to accomplish a task on a computer, or just had an idea of what they would like to accomplish, but didn't have the technical skills to reach their goal. Of the participants who shared their stories with me, 5 out of the 6 considered themselves to be fairly to highly experienced when it came to using computers. Comfortable in their own skills, they admitted that, when confronted with a problem or challenge, the first thing they did was dig in and work to find a solution on their own. Alan shared that, "I'm one of those people who sits at a computer and figures it out. Okay . . . rarely do I not have some idea of how to do it." In the case of Emily, she speaks of reaching out to a colleague at times but relates that "a lot of times I'll sit down and I'll play around with it." Even with their level of confidence, the prospect of being confronted with a technological challenge is not unusual. In their conversations they seemed to feel that coming across a challenge involving the use of computers was just a normal part of the process, not necessarily an obstacle as much as an occasional expectation.

When it comes to spending time working through problems and advancing their computer skills, Jorge laughed as he described how he spends lots of time at home just learning programs just because he likes computers. But he also has the conviction that technical knowledge is important to a teacher. "I really truly think that if you are a teacher you have to know computers and you have to know how to use them."

Similarly, Alan admits that the time he has spent working with technology and computers has become "my mistress. I've just spent a significant portion of my life with computers, finding out what it will do. Much to the dismay of my wife."

For them, when a situation arose where they were not meeting with success regarding overcoming the challenge, the first place all participants sought support was from friends and colleagues. For each of the participants, there was some form of informal support group that worked together to exchange ideas and provide support for technological challenges. They not only drew on the strengths of each other to overcome the technological challenges they encountered, but they also used this group to strengthen how these skills related to their instructional practice. And these informal communities were not confined to a particular school district. Mary responded immediately saying that she called her friends at another school. She had worked in the other school system prior to taking her current, full-time position, and maintained connections with them. Part of this is due to the connections there were established previously, and part was due to the available resources at the other

schools. An interested teacher in an environment with superior, available resources proved to be a terrific combination for her needed support.

Only one person even brought up the issue of support when it came to getting help about how to accomplish a task beyond their means, and that was to describe how the formal support was typically inaccessible and so alternative means, through friends and colleagues, were necessary.

> There's several teachers I use for good resources; unfortunately the computer teachers don't know a lot of the material that's on my computer, so, I either keep guessing or try to get a hold of the teachers that taught in the classroom before I did, that might be familiar with the programs. I try to call the technology department to see if they can't come within the next couple days . . . it's, um . . .

She trailed off with this thought with a slight, wry sort of laugh giving a sense of the futility of the attempt. This also comes from the participant with the least depth of knowledge of technology and computer skills. As a recent college graduate, Cassandra had just completed her first year of teaching. She had a single computer class in high school and, throughout college, used a typewriter for her work. Much of what she learned came from her first teaching experiences as a substitute teacher going into the computer labs during teacher preparation time to try to figure out what the latest stuff was and how it worked.

In addition to the two most prominent approaches to tackling an unknown task, either working it out on their own or seeking out friends and colleagues, teachers mentioned that they would solicit the help of their students. When describing how she has continued to embrace learning about the computer and what to do when she gets stuck, Emily credits her students for the help: "We've got a lot of good

computer literate kids, that, you know, if you have a question . . . why is this not printing this way . . . A lot of kids won't know, but a lot of them will."

In a situation where Michael was working to maintain a network when it failed, he said that he reconfigured the network environment from a server-based network to a peer-to-peer environment. "My students taught me that."

Results of the Study

In a multimethodological study, the results of either the quantitative or the qualitative study, while individually may be interesting, must be considered together during analysis (Thomas, 2003). This study was based on the use of the concurrent triangulation strategy defined by Creswell (2003), whereby the two methods of research would act to confirm and cross-validate the findings for this single study. It was therefore the intent of this study to determine whether an understanding of a convergence or divergence between the survey data and interviews existed.

The first research hypothesis sought to understand whether teachers felt having time made available to practice and experiment with computers was important to them, and the extent to which their own schools supported this activity. An analysis of the survey data revealed that teachers found this to be important to them, and that their perception of actual school support in this area was significantly below their expectations. A careful analysis of the interview data lends support to these results. Teachers expressed frustration about the limited time available to them for purposes of practice and experimentation.

The second research hypothesis sought to understand if teachers felt having access to technology professional development at a time and location that supported their instructional needs was important, and whether their schools adequately supported this activity. Teachers responded in the survey by indicating that technology professional development was important to them and that they felt their schools fell significantly below their expectations when it came to supporting their technology professional development needs. An analysis of the interview data provided additional support showing that teachers had either limited access, or engaged in technology professional development activities that have been revealed in the literature as ineffective. This included technology professional development that has been termed as "one-shot sessions" or "sit-and-get training" (Browne & Ritchie, 1991; OTA, 1995; Siegel, 1995; Sparks, 1997; Sparks & Richardson, 1997). Other concerns expressed during the interviews included the lack of hands-on training, large disparities between the skill levels of participants, lack of direct application to their instructional practice, and too many people attending with limited support available to the participants.

The third research hypothesis sought to understand whether teachers believed it was important to be involved in the design process of technology professional development activities and whether their schools' support met their expectations. Results from the survey revealed that teachers believed that being involved in the design of technology professional development was important to them. The survey data also revealed that the teachers believed that their schools' support for this

activity fell significantly below their expectations. A careful analysis of the interview data revealed support for the survey findings. Emily provided a rare glimpse at what involvement looked like when she was involved. She was upbeat in her conversation and spoke quickly about the interaction from the other teachers. For other participants, attending sessions designed outside of their input made for frustrating sessions engaging in activities that met little or none of their instructional needs.

The fourth research hypothesis examined whether teachers believed that having immediate access to technology following technology professional development was important, and whether their schools provided this access to meet teachers' expectations. From the survey it was revealed that teachers believed that having access to technology was important to them. It was also revealed that teachers felt their schools failed to meet their expectations when it came to providing access to technology in a timely manner in order to meet their instructional needs. An evaluation of the participant interviews provided additional support for these conclusions. Teachers were required to wait for equipment or software or, as Alan lamented while attending one session, "Next thing, not having the equipment working properly, or 'yours isn't going to be quite like this, this is a little different version' kind of thing. The old 'one-size-fits-all' mentality. Those are all turn-offs to me."

The final research hypothesis considered the availability of support for teachers. Teachers were asked to report whether the availability of support was an important part of using technology in their instructional process. They were also asked to report whether they felt their schools were meeting their support needs. The

results of this study found that teachers believe that support is an important consideration when using technology in their classrooms. The study also revealed that teachers believed their schools failed to meet their expectations when it came to providing technology support. The participant interviews supported the findings of the survey, revealing that support was a concern and that they were often left to their own devices. The issue of overburdened technology staff was mentioned on various occasions as an issue for limited access to support. Another interesting issue that came from this was that, while the literature strongly suggests the importance of leadership support for technology implementation and use in the classroom (Cooley, 1998; Sergiovanni & Starratt, 1998; Sparks, 1997; Thompson & Cooley, 1986), no mention of administrative participation or support was mentioned by the participants.

Summary

Chapter IV included the results to both the quantitative and qualitative findings for this research. The survey administered to K–12 teachers in a single intermediate school district was designed to understand teachers' perceptions of whether certain aspects promoted in the literature were important to their ability to integrate computers into their classroom instruction. Teachers were also asked whether the schools where they taught met their expectations when it came to supporting these needs. For each of the criteria, seven questions were posed to provide for a comprehensive understanding of teachers' perceptions of the importance of the criteria and the extent to which it was supported within their own schools. A

copy of the survey questions can be found in Appendix B. The five specific criteria included *time, training and development, teacher involvement, access to technology,* and *ongoing support.* Time was considered to be the availability of time for teachers to practice and experiment with computers. The purpose would be to better understand the technology and work to apply it within the context of a classroom environment. Training and development reflected the availability of technology professional development for teachers as it was needed. Teacher involvement considered the extent to which teachers provided insight into the design, implementation, and follow-up of technology professional development sessions. Access to technology considered whether teachers had timely access to technology, both hardware and software, immediately following technology professional development, and whether the equipment used during technology professional development accurately reflected what the teachers were using in the classroom. Finally, ongoing support sought to understand how support following technology professional development played a role in the teachers' capacity to utilize computers in the instructional process at the conclusion of technology professional development and throughout the teaching process.

For each of the criteria areas (time, training and development, teacher involvement, access to technology, and ongoing support), the means of level of importance were compared with the means of actual implementation. This was done using a paired-sample *t* test, and in all cases the results were found to be significant. The magnitude for *time, teacher involvement,* and *ongoing support* were all

determined to have a large effect, whereas the criteria for *training and development* and *access to technology* were all found to have a medium effect.

In each of the major criteria identified in this research, teachers confirmed that the criteria were important to them when considering what was necessary to assist them in the implementation of computers into their instructional process. In each of the criteria areas, the null hypothesis was rejected in support of the alternative hypothesis. This indicates that while teachers consider *time, training and development, teacher involvement, access to technology,* and *ongoing support* necessary so that they may incorporate computers into their instructional process, actual practice by the schools to meet these needs, on the other hand, fell below their expectations.

Other Findings

In the research design, the use of the constant comparative methodology was identified as the means for qualitative analysis. To honor this process it was important to read and code the transcripts numerous times in order to generate themes. The five themes outlined in this research clearly emerged during the interviews conducted with the teachers. What is interesting is that one theme could be subsumed within a larger framework. Time and access to technology were clearly defined as a unique category. The theme of support was found to exist within what was considered *community development* which subsumed the theme support. Formal technology support was mentioned very little and within the context of a somewhat remote and inaccessible

structure. But it did emerge. Individual support was found to occur frequently and informally by teachers reaching out to each other when an immediate concern arose regarding technology use. Additional support and development was found when teachers exchanged ideas informally about problems and solutions they had experienced. *Community development* would certainly align with Senge's (1990) principle of team learning. The process of teachers coming together to share in the learning process creates strength and cohesion within their small community of learners. The absence of a formal and available support structure for teachers may create a misalignment in the overall structure of *community development* creating wasted energy.

The classroom environment emerged on its own as teachers described their comfort learning and applying technology alongside their students. Cassandra related her frustration and her students' frustration after she could not adequately use computers in her class following what she felt was an unproductive training session.

> I think the kids were as frustrated as we were because you're still finding, you know, things are confusing to you and you can't really expect the kids to do it if you don't know how to do it and [pause] it was just, it was frustrating.

Conversely Emily expressed her open regard for her students' computer knowledge and her willingness to learn from them.

> . . . and a lot of it, I think, comes from the kids. We've got a lot of good computer literate kids, that, you know, if you have a question, I always ask questions, you know, why is this not printing this way, why can't I print blah, blah, blah. A lot of kids won't know, but a lot of them will.

Michael also affirmed that reliance on computer support can come from students when he made a change from a client-server arrangement to a peer-to-peer.

When he referred to the new peer-to-peer environment, he remarked simply, "My students taught me that."

Technology Subculture

From the survey it can be confirmed that teachers consider time, training and development, support, input into the design, and immediate access to technology to be important issues with regard to a comprehensive plan for technology professional development. It has been widely understood that teachers are widely unprepared to teach in classrooms equipped with technology (Doering, Hughes, & Huffman, 2003; OTA, 1995; Siegel, 1995), yet during the interview process I found that all but one participant was strongly motivated to use technology, had a history of personal use and experimentation, and projected a sense of "no fear" when it came to digging into how to use them. For some, working on the hardware and performing software installations was not an unacceptable activity. The other participant, Cassandra, was less comfortable, but as a new teacher had very little experience in technology as it relates to the classroom. She did have a very positive experience with specialized technology used for a verbally impaired student in her special education program. Hers was not as much an issue of apprehension as it was lack of technology education.

So, who are the people whose needs are not being met and where are the voices of the teachers unprepared to embrace technology in their classrooms and

why? An interesting theme started to develop as the conversations with the participants emerged.

It may then be possible to stratify teachers into groups arranged by how they embrace technology. The first is a technology "overclass" where teachers are well versed with computers and technology and have spent a substantial amount of time for their own development out of personal interest and enjoyment of using technology. Part of this same overclass may include teachers who may not be as savvy but are unafraid and willing to ask questions, explore on their own time, make mistakes, and generally welcome technology environments.

In contrast to the overclass exists what I consider to be the technology "underclass." This group consists of teachers who are not comfortable with technology and in fact may be quite afraid of it. They do what they can by working around its use by keeping manual systems and then soliciting the help of colleagues. Eventually, they either stay late on evenings or come in on weekends to use technology, typically soliciting the help of others at the last minute. Their use of technology is predicated on the fact that it is mandatory.

The Michigan Teacher Technology Initiative was designed to provide technology to every public school teacher in Michigan. The State of Michigan, guided by then Governor Engler, proposed a solution for teachers to become immersed in technology so they could be better prepared to integrate technology into their classroom by giving all teachers a laptop computer. In order to receive this computer,

teachers needed to complete an online survey with available computer training found online.

It seems that the people who were most comfortable with technology were eager to obtain more. As discussed earlier, the computers that teachers received were used as an extra classroom resource for students to use. Their comfort level with computers was already established, so the acquisition of a laptop for the purpose of their technological development was not a strong issue. Conversely, the teachers who were limited in their technological skills, or had none at all, ranged anywhere from being reluctant to try to go online and complete a survey, to being downright afraid. With the desire to secure additional technology for themselves, and aware that their teaching staff had to complete the surveys, the technology savvy teachers either sat with the less able to guide them through each step or completed the survey for them to ensure their school would be onboard.

Teachers who were comfortable with technology remained comfortable. And if they were able to adequately negotiate with other teachers and administration about its use (which in itself became very political and had its own episodes of cultural fallout), they may have obtained another resource or a new tool that made bringing work home and back to school a bit easier. For some, it may have also provided something new and interesting, such as a digital camera, to create new opportunities. Teachers who were not comfortable with technology may be no further along than they were prior to the Michigan initiative and right where they were when the OTA (1995) produced their report about the state of teacher readiness and their use of

technology. With a few teachers who are strong in their technology skills working within a school system, the larger population of undertrained teachers may be able to remain under the surface—acquiring just enough skills to use a grade book program, or, as described by Jorge, doing everything with paper and pencil and then seeking one of the technology savvy people to step them through the technology at the end of the marking period. Teachers may not have to change or adapt. As an extreme, they just retire before using technology becomes an issue.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to understand teachers' perceptions of criteria that may be important to successful implementation of technology in their instructional process, and whether their schools adequately supported these criteria. Additionally, this study sought to explain the congruence or disparity of teachers' perceptions and actual practice. This chapter will organize the conclusions of the research based on the synthesis of the survey results and individual teacher interviews which were detailed in Chapter IV. The conclusions will follow an outline of the five original hypotheses.

Themes Perceived to Be Important

A central conclusion of the survey showed that teachers perceived the five themes to be important. The study also revealed that teachers believe that their schools failed to adequately address these. These issues focused on *time, training and development, teacher involvement, access to technology,* and *ongoing support.*

Theme 1: Exploring perceptions of the importance of time to experiment with technology following professional development and the actual amount of time schools provide to experiment.

The survey showed that time was an important issue and that teachers' perceptions of how well schools supported this theme fell significantly below their expectations. When the results of the questions were rank ordered by performance gap means, time to practice and experiment was considered to be the most important concern for teachers. This investigation confirmed that teachers believed time to practice and experiment was important, and that they felt this critical factor was lacking in their everyday experience. Participants who were interviewed spoke of colleagues who were afraid to work with technology and hesitant to use computers for daily activities. Even when mandated processes, such as maintaining a grade book and keeping attendance, were put in place, some teachers would avoid the computer until the last possible moment. The OTA (1995) reported that removing the fear of using computers and enhancing the experience of integrating technology into the classroom required strategic planning for providing teachers time to practice and experiment.

Engaging with other teachers and staff as part of a regularly scheduled process was cited as being the most important activity, not just in the category of time and experimentation, but for the entire survey. It is clear to the researcher that time to practice and experiment with new and existing computer technology continues to be a concern for teachers when working to integrate computer technology in the classroom. Making sure that teachers have available time is a critical leadership issue that must be addressed. Fostering the activity of bringing teachers together to exchange ideas with colleagues is something that educational leaders cannot leave to

chance. This research revealed that informal learning communities self-organized in terms of supporting existing technology and developing new and creative ideas in the classroom. It is not enough to rely solely on self-organizing systems. Having time was clearly the most important issue to teachers, and addressing this concern must be derived from a carefully designed strategic plan, initiated by educational leaders and involving teachers, support staff, and technology support.

Theme 2: Exploring perceptions of the importance of having access to professional development and teachers' perceptions that they actually have access to training and development that schools provide.

The issue of training and development considers teachers' ability to have access to technology training at a time when they have an immediate need, and where the content of the training addresses specific concerns of the teachers that they can readily apply to their classroom environment.

When asked about having access to technology professional development, respondents to the survey confirmed that this was an important issue, and that they perceived the responsiveness of schools to fulfill this need to significantly below their expectations. Through the interviews it became clear that teachers are still being sent to what I describe as a "training farm" where they are herded into large rooms for technology training. The teachers may be at a single computer, they may be doubled up on computers, or they may not have access to a computer all. Concepts and skill levels may or may not apply to those in attendance, and the frustration of attending such sessions was evident throughout the interviews. In Cassandra's view, three days

worth of material was condensed into a single-day session. The pace was hectic and she felt the overall process was very unorganized. Jorge was given the choice of attending professional development either during a school night or in the summer. To educational leaders, this may be considered providing flexibility in scheduling training and professional development activities for teachers. From this study, the researcher can easily conclude that this kind of activity is dichotomous to what the literature suggests is an acceptable learning environment. This environment is not learner-centered and does nothing to address a problem-centered environment necessary for learning to take place. Part of the problem may come from concerns of convenience. When discussing this training situation, Cassandra indicated that teachers from various schools were in attendance. Well intentioned schools may perceive value in sending teachers to training sessions that claim will provide teachers with specific skills at a time that is convenient. Without following up with the teachers, school leaders are failing to realize that the dollars spent on professional development may be yielding limited or no results.

Adult learning theory suggested that adults learn when the environment is problem-centered, and available when the participant is ready to learn. The two primary concerns expressed by teachers in the study were that (1) professional development takes place when teachers have a specific need, and (2) professional development is readily available. For the researcher, it is clear that guiding professional development schedules around convenient blocks is still practiced and

continues to be a barrier to the appropriate development of technology use for teachers in the classroom.

Theme 3: Exploring perceptions of the importance of being involved in the design process of professional development and the degree to which teachers perceive they are actually involved in the design process at their schools.

During the design of professional development, teachers must be involved in the process. The content must meet a specified need of teachers and this can only take place when they are directly involved in the process. This also precludes a strictly based "set and get" or "step-by-step" process, which has been written about extensively in the literature. It is possible that short exercises may be utilized when presenting concepts for the first time, but these should be limited and used in larger, project-based environments.

From the results of the survey we find that teachers agree that being a part of the design process when it comes to technology professional development is important. Professional development should be designed to facilitate learning within the context of the teachers' own instructional environment. The survey also revealed that teachers' perceptions of how schools involve them in the design of technology professional development falls significantly below their expectations. Teachers felt that it was important to be a part of the design process and that they wanted to establish professional development as an opportunity to create something they could immediately apply to their classroom instruction.

When the participants have been involved in the process, they experience a very rich and positive learning environment. It is impossible for somebody to put together some kind of training session that meets the needs of all the participants, yet this process is continually used. Emily related the difficulty of attending a session where the content was designed and implemented without her input: "There was just none of that there, you know, because [pause] their person had a definite agenda and they needed to stick to it, and they needed to get it all done. And the step by step by step."

This experience wasn't about meeting teachers' needs based on their input. It was about careful scripted timing to get through a specified number of steps in a given amount of time. This would suggest that professional development models are still being employed as mechanisms to swiftly cover as many steps as possible. This "sit-and-get" (Sparks, 1997) approach for professional development has been documented as ineffective, yet it still prevails.

The frustration can really be understood from stories revealed when asked about their most disappointing experiences while attending technology professional development. Alan's comments were quite revealing when he suggested that he was being presented with information during technology professional development that "I could have found on my own by trying something that would take, and I'm not kidding here, 30 seconds."

In the eyes of this researcher, there is no reason why a teacher should participate in any professional development activity which does not fully meet the

needs of teachers. No teacher should be engaged (perhaps subjected to may be more appropriate) in any activity where they have to wonder how the content may have anything to do with their instructional environment. It is wholly inadequate to have teachers indicate that they learned one or two new things out of an entire session. The entire activity must be relevant. This can happen only when teachers are directly involved in the design process.

Theme 4: Exploring perceptions of the importance of immediate access to technology following professional development and teachers perceptions that they actually have immediate access to equipment following technology professional development.

The theme of access to technology considered whether teachers had access to technology immediately following technology training activities. This considered not only whether the technology was available, but whether it was configured similarly to what was used during the training process. When responding to the survey, teachers agreed that this was an important requirement in order to integrate technology into their instructional process. They also indicated that their perception of how well schools met the goal of ensuring immediate availability and similarly configured equipment fell significantly below what they felt was acceptable.

Technology professional development is a process that must support a strategic effort to integrate a technological process within the teachers' domain. Whether the technology is used as a mandatory school-wide process for automating student grading, attendance, and scheduling, or for individualized educational pursuits

such as using the Internet to do research for history projects, the training must be tightly coupled to the specific need of the teacher and the technology must be immediately available for implementation. This was apparent in the case of Cassandra when she was able to apply the concepts learned about her use of the Vantage system for her nonverbal student. She was able to apply the concepts the next day with technology already in place. Both she and her student found immediate success in an experience where they were both, suddenly, able to communicate at previously unachievable levels. Their joy of success wasn't due to the computer, but to their personally interactive experience. The technology served to support their personal learning environment and focused on student achievement.

This study found that the primary concern for teachers when it came to issues of access, was whether computer software was installed and running properly following professional development activities. It was important that the software was installed and running and also that the software installed for their use was similar to the software used during their participation in professional development activities. It was made clear to the researcher that listening to explanations about how the software used during professional development would differ from teachers' actual classroom systems was not acceptable. It is also important to note some more closely aligned responses to teachers' perceptions and actual practice. There is no question that the results of this hypothesis were statically significant, and that the calculated effect was moderate. Of all of the questions, some of the closest margins were found around the issue of computer availability. In fact, the question of whether computers

were readily accessible to use following any technology professional development activity resulted in a negative value (–.02) when calculating a mean gap analysis. This may reflect more positively on the issue of schools working to ensure that hardware is available for teachers and students. Further study may be helpful to determine availability of hardware and software as mutually exclusive issues.

Theme 5: Exploring perceptions of the importance of ongoing technical support and teachers' perception that the level of ongoing support at their schools meets their needs.

Ongoing support spoke to the issue of providing resources which were readily available when teachers encountered difficulties trying to apply technology within their instructional process. When responding to the survey, teachers felt strongly that the availability of support was an important issue for them. They also responded that the extent to which their schools provided adequate support did not meet their expectations. The role of support must not be ignored in any technology deployment or considered an afterthought. This must be a carefully planned part of the technological infrastructure. Simply hoping the teachers can find answers to their questions cannot be left to chance (McDiarmid, 1994). Depending on the size of the school system, the role of the technology specialist may vary. In larger systems with complex infrastructures, network engineers and support specialists may be considered unique, full-time positions within a district, whereas in a smaller system teachers may act as technology support within the school (Cooley, 1997). In the latter case, this

situation still requires that this be an explicit position so that teachers know who to contact when they need help.

From the response of the teachers, it is evident that this need is going unfulfilled. When responding to the survey, 3 of the top 10 concerns outlined related to issues of support. The most important concern was that computer maintenance problems were quickly taken care of. Michael addressed this issue when he mentioned that the process to get a computer repaired was to contact support and then wait 6 to 8 months for a response. Teachers who are experienced with computers and technology may be able to provide some of their own support. Others, such as Cassandra, are limited in their ability and must rely on support for their needs.

The second support issue that was found in the 10 most important questions was that support staff was readily available. Because this need was not being met, Cassandra became more reluctant to work with the technology. Her quote is salient because it speaks to her uneasiness of calling on others when support was not available.

> . . . unfortunately, the computer teachers don't know a lot of the material that's on my computer, so I either keep guessing or try to get a hold of the teachers that taught in the classroom before I did, that might be more familiar with the program, um, I try to call the technology department to see if they can't come within the next couple days [slight, wry laugh] it's um it usually takes, um, a couple days just because they're so busy, and with the older computers I think they're more apt to working on the newer models, um, then they are . . . we usually just get the leftovers of what's left from the technology department.

The last question in the area of support that teachers perceived as one of their top 10 concerns, considered whether hardware and software support was readily

available. This involves keeping the systems running and also for supporting instructional concerns. Technology coordinators and support staff can be instrumental as change agents (Strudler, 1994). It is important to understand that teachers will use technology in their classroom environment when they consider it to be a reliable resource. Many of the teachers who were interviewed were comfortable with computers and technology. They understood the importance of support and developed their own informal support structures with other colleagues. This is an important finding and worthy of exploration. The development of these networks may prove to be a cost-effective support structure for schools. What is obvious from the data is that the formal structure for providing support for teachers is inadequate and creates unstable environments for successful computer implementations.

Other Findings

An interesting finding from the results of the survey indicated that teachers were less concerned with being grouped together by grade level than what was actually taking place in their schools. This may be better understood when considering the responses by teachers in the interviews. A greater concern for teachers was the lack of homogeneity by skill level. Jorge, who holds a master's degree in educational technology, was frustrated when he attended a professional development session where other teachers were struggling with how to properly use a mouse. Emily spoke of following along in a step-by-step training session where she would complete her steps only to wait while other teachers struggled to keep up. Grouping by grade or by

curriculum may offer advantages for strengthening teachers around communities of practice, but clearly skill level plays a role in the effective delivery of professional development. Another interesting finding that emerged from the interviews was how support among teachers develops on an informal basis. Teachers who are comfortable and skilled with computers and technology in general are binding together to create their own communities of support. Interestingly enough, those who are not accomplished with technology may be situated below the surface. It is not clear what might be happening to what I describe as the "technology underclass." These people are the teachers who are not comfortable with technology, are unable to connect with any formal support system, and have either limited or no association with informal support structures. Perhaps they are the people that Jorge refers to when he described the following:

> And the, last year we started with the electronic attendance and grade book, and boy [pause] I know people who have retired before, they were thinking of retirement just because they couldn't handle those programs. And I have teachers who just hate those ideas of having to do the attendance, and the grade book and the computers. And, I know right here I know quite a few carry their books around and at the end of the week or at the end of the marking period they have to come here Sunday morning, Saturday nights to enter all that information into the computer. And a lot of time they need help, and they get so frustrated.

Lack of technology support causes a strain within the educational environment from a couple perspectives. For teachers struggling to implement computer technology in their teaching environment, they must rely on help from others which can cause personal issues of being an annoyance to others over time. Not getting any help creates growing frustration and the potential development of work around

systems where manual systems are maintained and then the help of others at the last minute are used to complete the technological loop. For teachers who are comfortable with computers and technology, they become the constant (yet informal) support system, giving up their own time to support others in their school. This is not to argue that the informal support structure is a detriment to the educational culture, quite the contrary. This researcher would contend that it is an important element of the overall support process. It is only when this informal network becomes the only means available to teachers in support of their technological concerns that it poses a threat.

It is noteworthy to take a look at the responses of this survey with respect to curriculum. Figure 7 shows an overwhelming number of teachers who responded by discipline. Of the respondents, 51.7% indicated that they were associated with social studies. This category clearly constituted an overwhelming majority of respondents to the survey.

Data were collected about participation in the Michigan Teacher Technology Initiative. This initiative was a state-wide program to provide teachers with laptop computers. The responses to the survey would indicate that the overall impact of providing teachers with computers in order to enhance technology use in the classroom was minimal. Of the teachers responding to the survey, 72.1% (76) indicated that they participated in the initiative as indicated in Figure 8.

A total of 76 teachers indicated that they received some form of technology by participating in the Michigan Teacher Technology Initiative. Of those who responded, 49% (37) received a laptop and 51% (39) received some other form of technology.

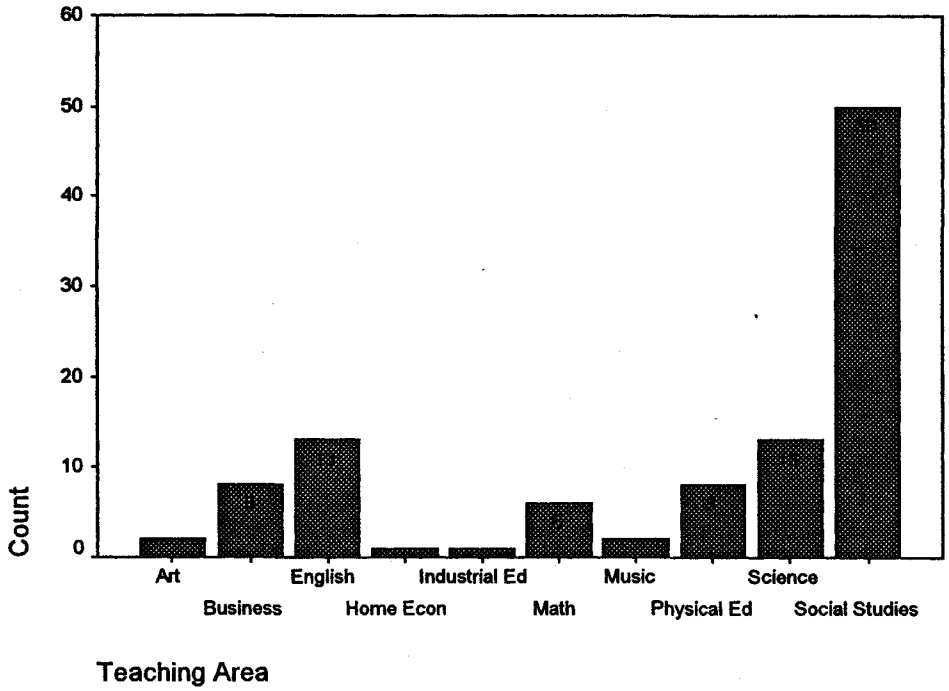

Figure 7. Survey Respondents by Teaching Discipline.

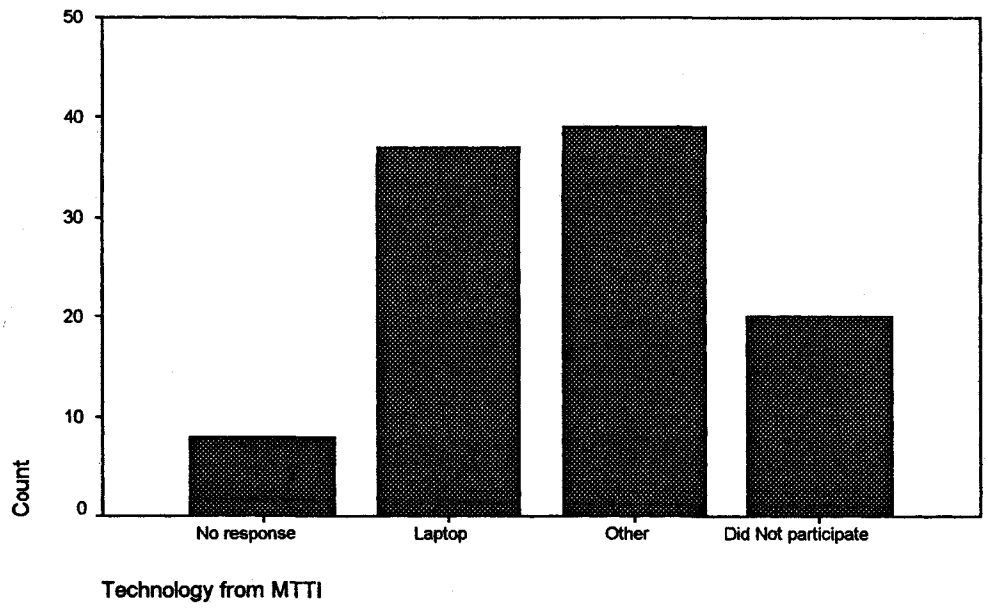

Figure 8. Type of Technology Received.

The initiative allowed teachers to receive other technology as an alternative to a laptop computer. Other forms of technology may include such components as digital cameras, color printers, and scanners.

Those who participated in the Michigan Teacher Technology Initiative were asked to respond to what effect they perceived receiving the new technology had on their classroom. The scale went from 1 to 5 and included (1) no difference, (2) some effect, (3) tried new things, (4) important to integration, and (5) transformed my classroom; these are represented in Figure 9. Of the responses (77), 54% (42) responded that it made no difference or some effect, 31% (24) indicated they tried new things, and 14% (11) indicated that it was either important or transformed their classroom.

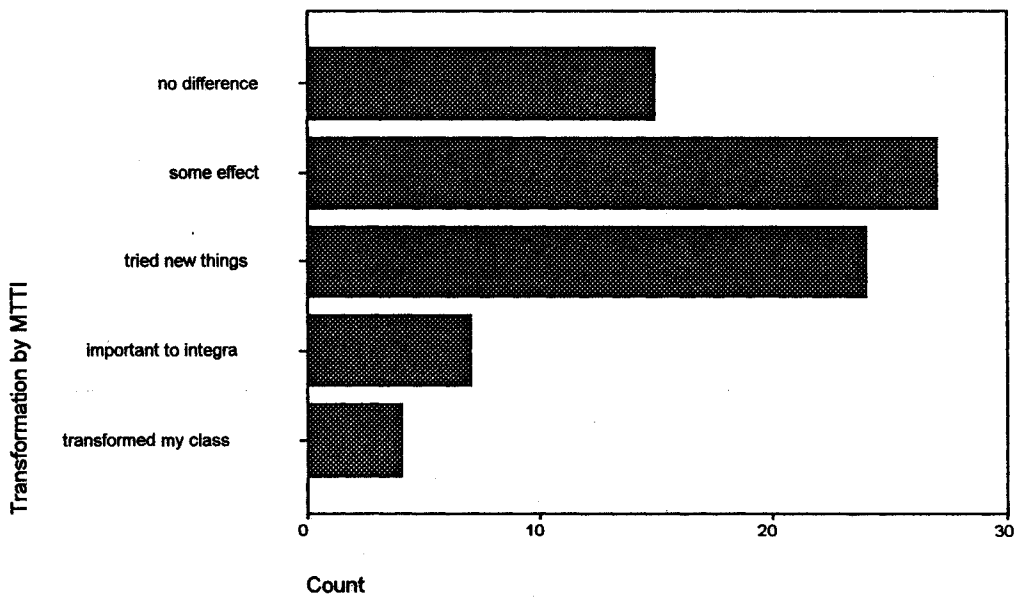

Figure 9. Perceived Effect of Receiving Technology From MTTI.

The initiative caused some difficulties for administrators and teachers when trying to determine how to proceed. For example, Alan was caught up in a struggle with his school over resources, which, in his opinion, the school won. Rather than receive a laptop computer or other technology for his personal use, administrators used the funding to help build their school's computer network infrastructure. The concern for large scale initiatives and the ramifications they may have on teachers and technology use will be addressed in the synthesis of the research.

Synthesis of the Research

By the responses to the survey and throughout the interview process, teachers have clearly communicated that barriers to technology integration are a significant problem. In each of the five categories identified, the calculated means of teachers' perceptions of importance and their perception of actual school support were significantly different. A paired-sample *t* test was used and tested at an alpha of .05. In all cases, statistical significance was achieved. When tested for effect, all results were found to have a medium to high effect. Evaluation of the interview data through the use of constant comparative analysis provided added support for these findings with all five themes clearly emerging.

From this research, it is clear that from the perspective of K–12 public school teachers, the issues of *time, training and development, involvement, availability,* and *support* are important when seeking to integrate computer technology within their instructional process, and that the extent to which they believe these issues are being

adequately addressed in their school falls short of their expectations. In light of this disparity, how can these gaps between teachers' perceptions and their actual experience be understood?

A computer, and any technology for that matter, is a resource and a tool no matter the environment it is placed within. As a resource, it must be placed into an environment where its application is understood by the person who will be using it. The skills of the individual must be appropriately developed so that the computer supports the desired results of satisfying the need. Think of a simple example where a woman who is a small business owner would like to take existing sales information for the previous 6 months and forecast possible future sales based on varying expenses and inflation rate figures. If accomplishing this task becomes too overwhelming, and paying attention to other issues of her business suffers, she may learn that an electronic spreadsheet can accomplish this task in seconds. If she were to receive training that specifically allowed her to create electronic spreadsheets to fulfill her need for doing sales projections for ther business, and then immediately begin to create them, she would enjoy the benefit of a powerful support tool.

But consider what would happen if we turned this concept around. It would seem absurd to take a computer with an electronic spreadsheet and approach the business owner demanding that she begin to use it in her business. With a computer now placed into her office, she then attends a seminar which leads her through a series of steps showing how various functions of the program work. At the completion of this session, she may have some idea of how the program works, but

when she returns to her computer, she still is unsure of what exactly the computer can do to aid in her productivity. Those who gave her the computer, expecting measurable improvement in her productivity, may voice their disappointment with her failure to improve. She will most likely become more and more frustrated with the dilemma of how to make it work to her advantage.

The difference in these scenarios is not that the woman is an excellent business owner in the first example and less competent in the second. The variation is found in the direction of the influence. In the second scenario, the structural element—the computer—was externally imposed. She was not instrumental in its acquisition, unaware of its strategic value, and unsure of how to apply the new technology successfully.

Colonization of Schools by Technology

In many instances, technology continues to be a broad-based solution looking for problems to solve. Technology, a computer specifically within the context of this research, is a tool that is best implemented when a problem has been identified and the solution well documented and understood by those who anticipate using the computer. Sergiovanni (2000) borrowed from Habermaas' (1984) theory of communicative action providing a theoretical framework of lifeworld and systemsworld to understand school culture and the challenges of educational leaders. The lifeworld is derived from cultural values, beliefs, and actions that are sustaining and meaningful to people. The development of the organizational culture takes place

by enriching the human experience through social and intellectual development. The systemsworld is a mutually exclusive world of structural elements necessary to support the lifeworld. In a balanced relationship, the lifeworld experience of teachers would then be to create and nurture a vibrant learning environment. The challenge is to create a space where students are able to actively construct knowledge and to devise methods and actions along with the necessary tools to support this dynamic learning environment. Emergent from this context, we would then seek to utilize all available methods and tools to support this process. This is the important condition guided then by the systemsworld. As a system of "instrumentalities" (Sergiovanni, 2000), the role of technology professional development would be to support the expressive and normative actions of teachers in the instructional process. The primary goal should be to use technology to support teachers' instructional environment. Similar to the example above with the small business owner, the teacher perceives value with the use of technology as a means to improve his or her instructional process, and that technology professional development should then support a transitional process for implementation.

Sergiovanni (2000) described two subsystems each for the lifeworld and the systemsworld. For the lifeworld, there is the expressive and normative systems. The expressive action within culture constitutes actions which express individual "needs, visions, values, and beliefs" (p. 6), whereas the normative action comes from seeking action "in ways that embody the school's shared values, vision, and beliefs" (p. 6). For the systemsworld, he refers to the teleological and strategic action, where

teleological action embodies goal setting and designing systems to achieve the goals. Strategic action is process oriented as a value-based decision making process for deciding among alternative actions. A healthy environment suggests that a balance must exist between the two worlds and that the lifeworld must be a determinant of the systemsworld.

An inversion of the lifeworld and systemsworld becomes what Habermaas (1984) called "colonization of the lifeworld" (p. 335). He further details this condition by stating: "When stripped of their ideological veils, the imperative of autonomous subsystems make their way into the lifeworld from the outside-like colonial masters coming into a tribal society-and force a process of assimilation upon it" (p. 355).

It is my contention that this theoretical framework utilized by Sergiovanni and considered in the context of school organization can be applied to explain disparities in successful technology implementation by teachers. When technology becomes an imposed system from external forces into the teaching environment, teachers experience a colonization of their lifeworld and, thus, a technological inversion.

Public schools are inundated by external forces which seek to shape and reshape their expressive and normative actions. In the state of Michigan, an initiative to provide every teacher with a laptop computer was passed with some expectation that putting technology into the hands of teachers would bring them into the computer age. In order to receive the laptop computer, the teachers had to access the Internet and complete a survey. Online teacher technology development was also available for those who had limited technological ability. This research sought to

better understand how getting a laptop computer or other technology changed teachers' instructional environment. Teachers were asked (both in the survey and also the interviews) what kind of impact this initiative (the Michigan Teacher Technology Initiative) had on using technology in their classrooms. A Likert scale was used ranging from 1 to 5, where 1 indicated "had no effect" and 5 indicated "transformed my teaching practice." Of those who responded to the question on the survey (N = 104), 37 indicated that they received a laptop computer and 39 indicated that some other technology was obtained. For those who indicated that they participated, 19% said participation had no effect, 35% indicated it had some effect, and 31% said they tried some new things. Cumulatively, 86% of those who participated in this initiative responded between it having no effect to trying some new things. Only 14% felt that it was either important to their instructional process or transformed their classroom practice.

In the interviews, some respondents indicated that if they received a computer, it was used as an extra resource for their class. For Mary it provided an extra computer in her classroom, giving her a total of two computers in her classroom. For Emily it provided her with her own home computer which became an extended tool for work.

> Okay, I don't know if I should say this but mine's not in my classroom, mine's at home. So, I got an ibook and I brought it home and [pause] do I use it for my classroom stuff?...ya. I mean everything I type and everything, you know, calendars I make and things like that, it's all in there. My email from school is hooked up to that, so I, I can dial into the server and get everything from work.

In a similar situation, Michael used his laptop to bring work back and forth from school and home. He was using a desktop PC at home and would burn CDs to transport data back and forth. With the laptop he could do some work at school, fold up the laptop, and take it home to finish the work there.

For Alan, participating in the Michigan Teacher Technology Initiative was much more a political battle for acquiring the technology. In the end, the school used the initiative to purchase networking equipment for support of their school infrastructure.

> So we, it was far more exciting than what I'm telling you now, but I had resigned from the committee, and I felt like I had just been stomped on and we ended up networking the building with our money.

The technological direction for participants who participated in the Michigan Teacher Technology Initiative seemed to appear as an afterthought. There was no indication that receiving the technology fit into an individual plan for supporting or enhancing the curriculum or instruction. The focus appears to have been to get additional equipment while it was available. This is supported not only through the survey results, which show that only 14% of respondents considered the new technology important to their instructional process or transformed their classroom practice. In the case of Alan, the technology was consumed by the school to support the development of its network infrastructure.

The Michigan Teacher Technology Initiative was a state-wide plan to place technology into the hands of every teacher. It is entirely understandable that, in such a widespread application of technology, examples of teachers acquiring computers and

integrating this new tool to support their instructional process is inevitable. But, as an externally imposed system, we should be very suspicious of just how successful this type of initiative could be for schools from the perspective of teachers. This study reveals that technology professional development is not meeting teachers' needs. Large deployments of computers through government initiatives, while on the surface may sound like a windfall opportunity to schools, may in fact be seriously detrimental.

As this research is being completed, another initiative in Michigan is being formulated to place a laptop computer into the hands of every sixth grade student in the entire state. The State of Michigan has recently announced that, prior to the distribution of the computers to all of the children, the schools must come up with a plan for how these will be used to prove they are ready to receive them. Frustration is already growing as educators are unable to get clear answers about just what it is they are supposed to prove (Murray, 2003).

This massive attempt to roll technology into schools is exactly the concern expressed regarding colonization of schools. As further consideration for infusing technology into schools persists, serious concerns for preparing teachers still exist. When asked to report the number of hours of technology professional development they have participated in over the past 12 months, 70.2% of teachers reported that they were involved in less than 8 hours. The resources available to teachers such as college and universities (78.8% of whom report 0 hours of participation), and online resources (92.3% of whom report 0 hours of participation) are poorly utilized. Access to colleges and universities my pose limitations due to easy access and tuition costs,

but it is reasonable to posit that online access to technology professional development may provide a critical alternative. This suggestion comes from the understanding that the greatest number of overall hours invested by teachers in the technology development reported is by their own personal development.

A statewide initiative to flood schools with laptop computers for students in the sixth grade precedes both a determined necessity and an adequate supportive structure of professional development for teachers. The greatest concern for this initiative within the context of this research is, where does the technology professional development for teachers fall within the schools' strategic plan for acquiring these computers?

Limitations of the Study

Limitations of this study should be considered. The survey instrument was administered through a secure web site and teachers were invited to participate using broadcast email to the school districts. This study sought to reach teachers who had attended some form of technology professional development and used technology in their classroom. The school districts have been using email for several years, but there still exists the potential to exclude teachers who were not familiar or were not comfortable accessing a hypertext link on the World Wide Web.

The intent of this research was to better understand the perceptions of teachers regarding issues of technology professional development. In order to develop a study that was robust, a mixed method study combining a qualitative and a

quantitative approach was used. The method used was a concurrent triangulated strategy incorporating the use of a survey and individual teacher interviews. From a strictly narrative perspective, there may be concerns for the use of a single interview. Mishler (1986) warns of arranging a one-shot meeting, but because this interview is a part of a mixed method study it is not intended to stand on its own, rather to triangulate findings along with the administered survey outlined in the concurrent triangulated strategy (Creswell, 2003).

The study was limited to a single intermediate school district in the state of Michigan. While it contained a cross-section of rural, suburban, and urban schools, any attempt to generalize the findings of this study to a larger population should be done with caution. Another limitation of this study is that is focused solely on public teachers in the K–12 system and thereby excluded the voice of teachers in private and parochial schools.

Areas for Further Research

This research focused on the perceptions of teachers regarding agreement of whether aspects of technology professional development, specifically, *time, training and development, involvement, availability of technology,* and *support,* were important issues for them to successfully integrate technology into their instructional process. It also considered the extent to which they believed their schools adequately meet their needs in these five areas. This was done by using concurrent triangulated strategy (Creswell, 2003) involving both a survey and personal interviews. Further

research would be valuable to consider what administrators, teachers, and technology coordinators believe indicates successful technology integration in their schools and the extent to which each group feels it has been successful.

Additionally, other interesting themes appeared during the analysis of the interviews. During the interview process, all teachers referred to their immediate support system in terms of their fellow teachers. What was particularly interesting was that this informal community of support was not limited to teachers within a specific discipline, teachers in the same building, or even in the same school system. This study revealed that teachers were concerned with professional development that was available at a time when teachers had a specific need. It also revealed that time to experiment and exchange ideas with other teachers was their highest priority. It may be time to consider professional development as a spontaneous activity which may be very short in duration. Development and support of learning communities may directly meet these needs in a way that streamlines professional development and, at the same time, substantially reduces professional development budgets. Further research would be warranted to learn more about the informal support systems currently in place. It would be useful to see if these might prove to be sustainable, cost-effective mechanisms for future technology implementations.

Leadership is clearly an important factor in successful technology implementation and support, yet during the interviews, support from building administrators, when it came to technology deployment, was not mentioned. Further research would be valuable to consider the perceptions of teachers, administrators,

and technology coordinators regarding what they believed to be the most critical issues for success technology implementation into the instructional process.

Summary and Recommendations for Practitioners

Technology has the opportunity to offer tremendous opportunities for teachers and students in our public K–12 educational environment. This can only happen when critical factors, found necessary to support technology in education, are moved from theory into practice. Thoughtful integration of technology can transform the teaching environment (Renyi, 1998) and provide myriad opportunities not only to assist in creating a richer learning environment for students, but also to assist teachers in instructional design, delivery, preparation, and student evaluation and the record keeping process (OTA, 1995). The transition from theory to practice requires the support of leadership, effective professional development, explicit channels for help using clearly defined support positions, and strategic planning. These elements must precede the technology, not follow along with the hope of finding success after the fact.

Leadership

The responsibility of ensuring successful opportunities for teachers and students to engage in a technology-rich environment is through effective leadership (Senge et al., 2000; Sparks, 1997). Leadership must create a clear vision which reflects the norms, values, and beliefs (Senge, 1990) of the educational and this vision

must be clearly communicated and permeate the culture (Bass, 1985; Bennis & Townsend, 1995; Hackman & Johnson, 1996; Senge, 1990; Senge et al., 2000). The implementation of technology must be part of a well-defined strategic plan that is mutually understood and embraced by administrators and teachers with the full commitment to support the plan (Conca, 1996).

Effective Professional Development

Effective technology professional development is just as important to the actual technology and requires the development of time for teacher experimentation and practice (Hope, 1997b). It also necessitates spending time in an environment with available support and the opportunity to make mistakes without fear (Brodinsky, 1984; Hope, 1997b). Leaders must be willing to promote risk-taking (Kouzes & Posner, 1993; Senge, 1990; Yukl, 1989). Teachers must have access to learning environments which directly address their needs, and at a time when they are ready to learn (Cross, 1981; Knowles, 1990). The fact that "training farms" are still being used is cause for concern. Sending teachers out for a half day of "set and get" may seem like an economical process. But, if teachers return with no new appreciable technology skills and must then spend months trying to learn on their own, it can hardly be considered a healthy economical decision. Teachers must be an instrumental part of the design process and must have access to similarly configured equipment immediately afterward. And support must be more than just a naturally occurring survival technique.

Technology Coordinator

The role of the technology coordinator was defined in Chapter II. Depending on the size of the school system, this person or persons may fill full-time positions supporting the technical and instructional needs of the teaching staff. In a smaller school, it may be a specific teacher with exceptional technology talent willing to work with her or his colleagues. In either situation, it must be an explicit position and should be considered a critical part of a successful technology implementation. The purpose for such careful planning and implementation is not to force technology onto the teachers, but to get the technology to work for the teachers. It is another tool that they can use as an integral part of creating successful learning environments.

In ever-declining educational budgets, the availability of technology through state and federal initiatives may appear to be a welcome gift. This gift can come with a very high price if schools are not adequately prepared. Schools must consider their own technological infrastructure, hardware and software maintenance and support, how the technology supports instruction and learning, and how teachers will be appropriately supported when learning about and implementing the new technology to achieve the mutually agreed upon goals.

Technology Plans

Currently, schools in Michigan are preparing to receive laptop computers for all sixth grade students as a part of a technology initiative. This appears to be a wonderful opportunity yet, at the same time, many schools are unsure how to plan for

implementation, integration, and support, all of which require funding that may not be available. Receiving technology without these plans already in place, co-constructed by teachers, technology coordinators, and administrators, and the capacity to fully fund the design, may find that the computers will do little to transform the educational landscape. This is exactly the concern addressed in this research. In an environment where systems defined by teleological and strategic action drive normative and expressive action, technology professional development becomes an afterthought. Developing teachers through effective technology professional development becomes an issue of focusing on the technology and not to specific instructional needs. Additionally, forcing technology into classrooms without clear plans to support teachers will create stressful environments for both teachers and students. Computers are a structural component of the systemsworld. They cannot drive and shape the lifeworld of the teaching environment. Acquiring technology for the classroom must be accomplished as a result of strategic plans created by each individual school.

The purpose for technology use must be understood by all stakeholders prior to its arrival. Technology professional development must be derived from the needs of teachers and relate to applications that support student learning. Teachers must be afforded the opportunity to structure its design, provide time to practice and experiment with the technology, provide training and development at a time when teachers are ready to learn, ensure that computers are available and functioning immediately, and provide responsive technology and instructional support.

Appendix A

Demographic Data

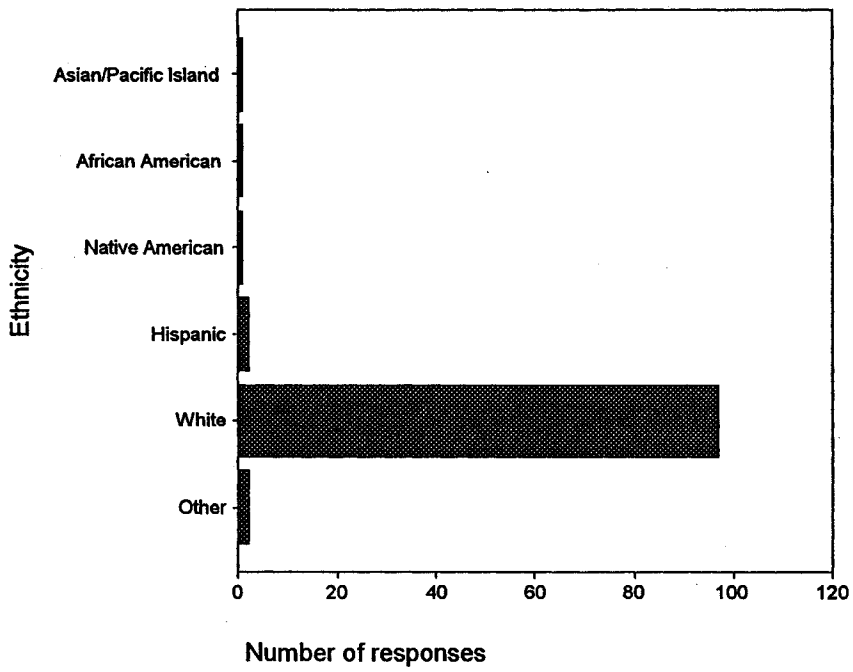

Figure 10. Ethnic Make-up of Survey Respondents.

Of the teachers responding to the online survey, 93.3% (97) reported their ethnicity as White, 1.9% (2) reported either Hispanic or Other, and 1% (1), reported Native American, Asian/Pacific Islander, or did not respond.

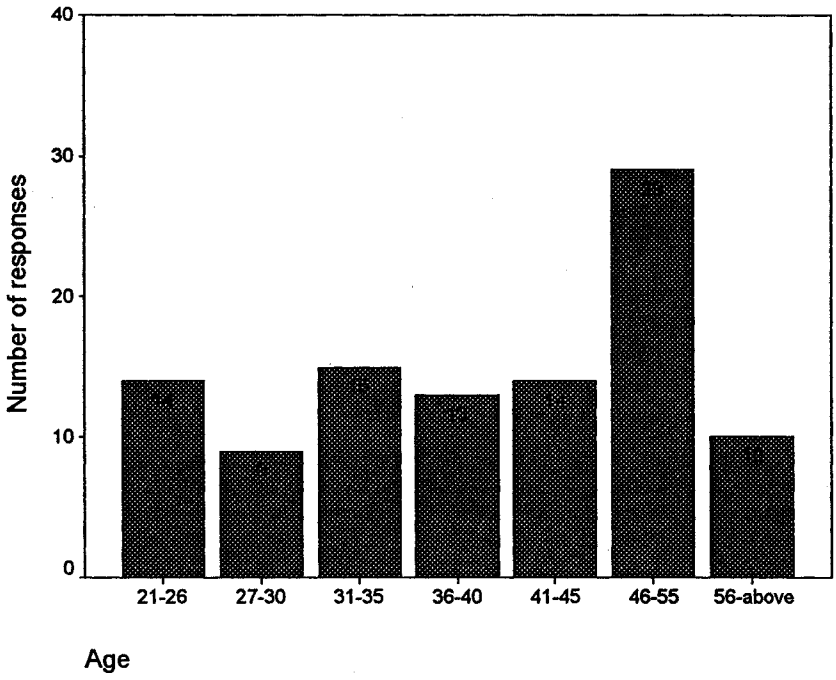

Figure 11. Range of Ages.

Teachers responding to the question of their age reported theirs as 21–26 at 13.5% (14), 27–30 at 8.7% (9), 31–35 at 14.4% (15), 36–40 at 12.5% (13), 41–45 at 13.5% (14), 46–55 at 27.9% (29), and 56 and above at 9.6% (10).

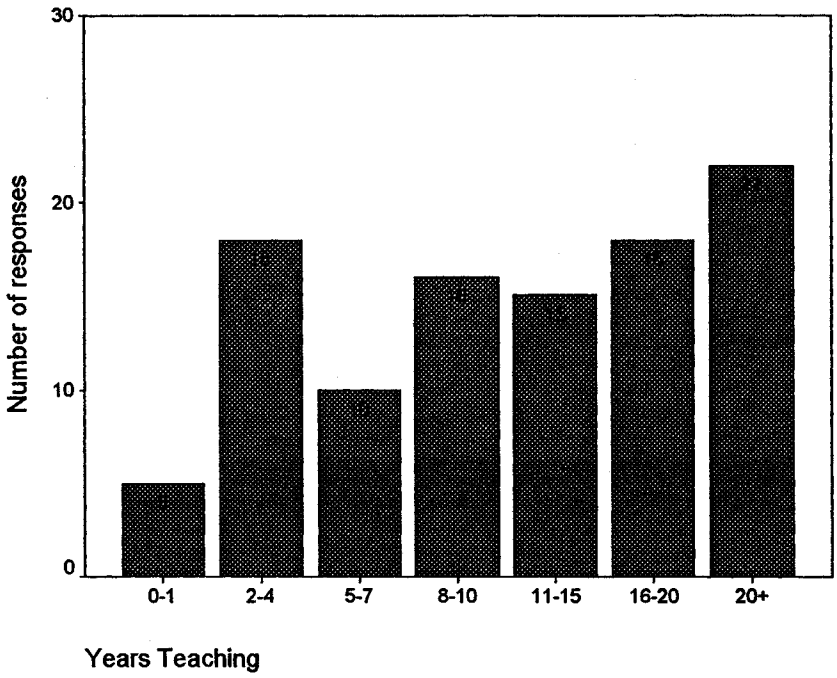

Figure 12. Number of Years Teaching.

Teachers reported the number of years that they have been a teacher by the following percentages and frequencies: 0–1 years at 4.8% (5), 2–4 years at 17.3% (18), 5–7 years at 9.6% (10), 8–10 years at 15.4% (16), 11–15 years at 14.4% (15), 16–20 years at 17.3% (18), and those who have taught more than 20 years at 21.2% (22).

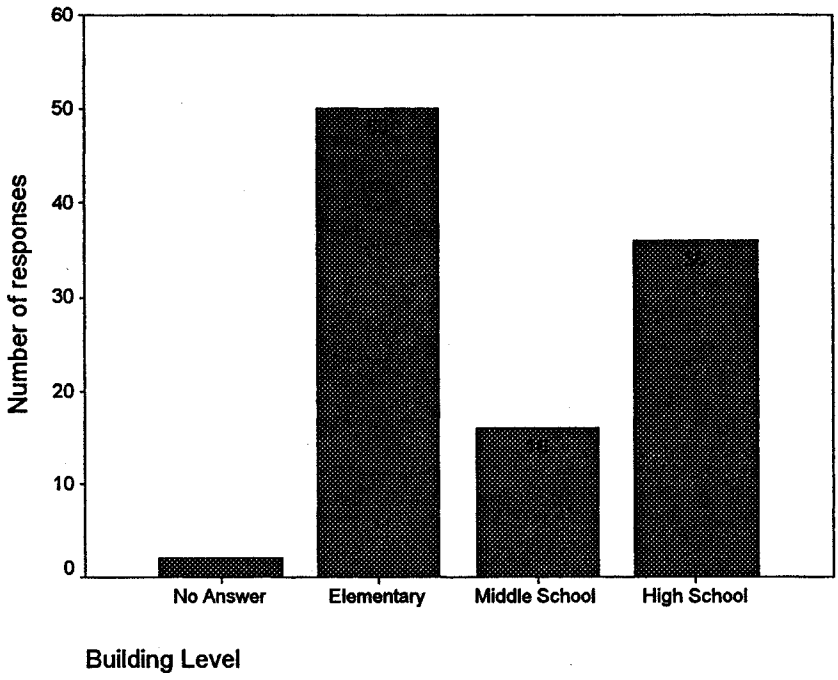

Figure 13. Grade Level by Building.

The survey was available to teachers at grade levels K–12, and they reported their building level as elementary at 48.1% (50), middle school at 15.4% (16), and high school 34.6% (36). Two teachers did not respond to this question.

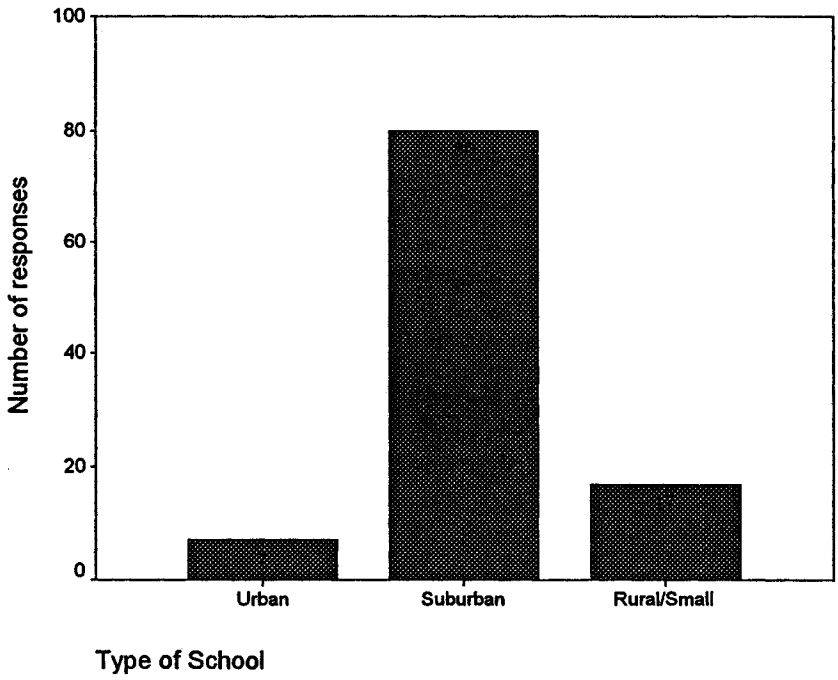

Figure 14. School Setting.

Teachers were asked to represent the type of school they were teaching in and their responses indicated that 6.7% (7) were from an urban district, 76.9% (80) were from a suburban district, and 16.3% (17) were from a rural/small district.

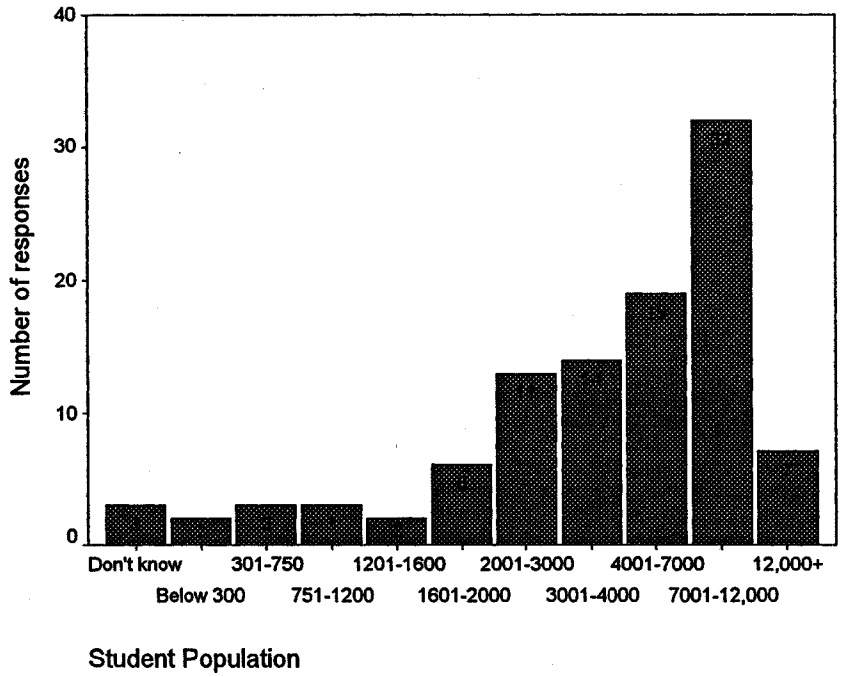

Figure 15. Number of Students in the School District.

Teachers responded to the question of student population in the school where they taught. The responses indicate that the largest percentage (30.3%) of teachers taught in school systems having between 7,000 and 12,000 students.

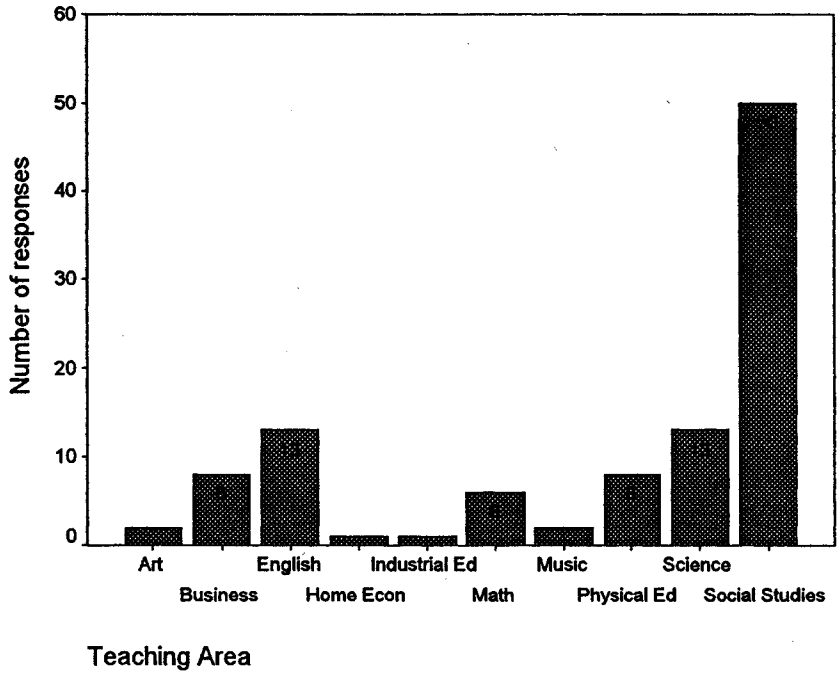

Figure 16. Discipline of Teaching Assignment.

Teachers were asked to indicate their major area of instruction. The responses by teachers to this survey were found to be quite interesting. With teachers responding from rural, suburban, and urban school districts, the overwhelming majority of teachers (51.7%) indicated their subject as social studies.

Appendix B

Survey Administered Online

Demographic Information

1	Gender Male Female	2	Ethnicity Asian Black Hispanic Native American White Other
3	Age 21-26 27-30 31-35 36-40 41-45 46-55 56 and above	4	Number of years teaching 0-1 2-4 5-7 8-10 11-15 16-20 Above 20
5	At which building level to you work? Elementary (K-6 or similar configuration) Middle School/Junior High High School Other (Specify)	6	Type of School Urban Suburban Rural/Small District
7	Approximate student population in your district Less than 300 301-750 751-1200 1201-1600 1601-2000 2001-3000 3001-4000 4001-7000 7001-12,000 Above 12,000	8	Major assigned teaching area Art Business Ed English Home Economics Industrial Ed. Math Music Physical Ed. Science Social Studies Other
9	Hours spent per year in technology professional development classes 0-3 4-7 8-15 15-25 More than 25	10	In the past 12 months how many hours would you estimate you participated in the following activities which directly related to technology and teaching: College course ____ In-school training ____ Off-site training ____ Online training ____

11	Have you participated in the Michigan Teacher Technology Initiative Program? Yes No	12	If yes to 11. Did you receive a laptop computer or other technology. If other please describe Laptop Other:_____
13	If you participated in the Michigan Teacher Technology Initiative Program, what best describes how this changed the way you currently integrate technology into your instructional process. 0- Made no difference 1- Had some effect 2- Provided an opportunity to try new things 3- Was an important part of technology integration in my classroom 4- Transformed how I use technology in my classroom		

The following questions seek to understand you perceptions regarding technology professional development. The first component, labeled **Importance** refers to how important you believe each of the concepts outlined in the question is. The second component, labeled **Actual Practice** refers to how strongly you believe the activity or concept is taking place in your school setting.

The scale is ranked from 0 to 4 with 0 being the lowest ranking and 4 being the highest ranking. Refer to the following chart as a guide for your responses.

Importance	**Actual Practice**
0- Not important	0- Not in practice
1- Somewhat important	1- Infrequent
2- Important	2- Sometimes
3- Very Important	3- Often
4- Critical	4- Always

DESCRIPTION	**Importance**	**Actual Practice**
1. The best location to hold technology professional development activities is at the school building	0 1 2 3 4	0 1 2 3 4
2. Technology professional development activities should be held during the day	0 1 2 3 4	0 1 2 3 4
3. Technology professional development takes place when teachers have a specific need.	0 1 2 3 4	0 1 2 3 4
4. Technology professional development is a mandatory activity for all teachers	0 1 2 3 4	0 1 2 3 4

DESCRIPTION	Importance	Actual Practice
5. Technology professional development groups teachers together by the same grade level	0 1 2 3 4	0 1 2 3 4
6. Technology professional development groups teachers together by the same teaching discipline.	0 1 2 3 4	0 1 2 3 4
7. Technology professional development is readily available	0 1 2 3 4	0 1 2 3 4
8. Technology staff are directly available to support my integration efforts	0 1 2 3 4	0 1 2 3 4
9. It is important that the technology support staff understand teaching and curriculum concerns.	0 1 2 3 4	0 1 2 3 4
10. Technology support is available when I need it	0 1 2 3 4	0 1 2 3 4
11. The establishment of a peer support group is very important when trying to work with new technology	0 1 2 3 4	0 1 2 3 4
12. Computer maintenance is quickly addressed when the system does not work	0 1 2 3 4	0 1 2 3 4
13. Technical Support is quickly accessible for both computer related issues such as hardware and software	0 1 2 3 4	0 1 2 3 4
14. Curriculum Support is an important part of integrating technology into the classroom	0 1 2 3 4	0 1 2 3 4
15. Technology professional development is designed so I can create something to be used directly in my curriculum	0 1 2 3 4	0 1 2 3 4
16. Technology professional development addresses issues that are directly relevant to instructional needs	0 1 2 3 4	0 1 2 3 4
17. Integrating computers into the school is part of a school-wide strategic plan with input from teachers	0 1 2 3 4	0 1 2 3 4
18. Teachers are actively involved in determining the length of the training activity	0 1 2 3 4	0 1 2 3 4
19. Teachers determine when the training takes place (time of day)	0 1 2 3 4	0 1 2 3 4
20. Teachers are included when designing professional development activities	0 1 2 3 4	0 1 2 3 4

DESCRIPTION	Importance	Actual Practice
21. Technology professional development links to directly to instruction.	0 1 2 3 4	0 1 2 3 4
22. Practicing with newly learned technology skills is a regularly scheduled activity	0 1 2 3 4	0 1 2 3 4
23. Time is made available to work with others to develop new instructional strategies with technology	0 1 2 3 4	0 1 2 3 4
24. Finding ways to integrate technology into instruction is a structured process	0 1 2 3 4	0 1 2 3 4
25. It is important to feel that it is safe to experiment and make mistakes with technology	0 1 2 3 4	0 1 2 3 4
26. There are opportunities to rehearse activities using technology prior to using them in the classroom	0 1 2 3 4	0 1 2 3 4
27. Time is made available to develop technology enhanced instructional activities with other teachers or support staff	0 1 2 3 4	0 1 2 3 4
28. Time is made available during the day to practice and experiment with the computer.	0 1 2 3 4	0 1 2 3 4
29. The hardware used during technology professional development is similar to what I use in the classroom	0 1 2 3 4	0 1 2 3 4
30. The software used during technology professional development is exactly what I use in the classroom	0 1 2 3 4	0 1 2 3 4
31. The computer hardware is in place when training activities are completed	0 1 2 3 4	0 1 2 3 4
32. Software in installed and running properly when training activities are completed	0 1 2 3 4	0 1 2 3 4
33. Computers are available on a consistent basis for me to use as part of classroom instruction	0 1 2 3 4	0 1 2 3 4
34. Computers are immediately available to use following any technology professional development activity.	0 1 2 3 4	0 1 2 3 4
35. Computers are available for students to use in the classroom.	0 1 2 3 4	0 1 2 3 4

Appendix C

Anonymous Consent Form

Western Michigan University
Department of Teaching, Learning, and Leadership
Supporting teachers using technology: Understanding teachers' perceptions of technology professional development
Dr. Van Cooley, Principal Investigator
James Brown, Student Investigator

Anonymous Survey Consent

You are invited to participate in a research project entitled Supporting teachers using technology: Understanding teachers' perceptions of technology professional development. This study is designed to examine teachers' perception of technology professional development programs believed to be critical to effective technology professional development and whether these elements are actually in place in the teaching environment. This research is being conducted by Dr. Van Cooley and James Brown from Western Michigan University, Department of Teaching, Learning, and Leadership. This research is being conducted as part of the requirement for the dissertation of James Brown. It is hoped that the findings from this research will be helpful to you as a teacher by better understanding potential barriers to implementing technology into the classroom environment.

The survey that you are about to complete contains 12 demographic questions and 35 two-part questions that you will rate. It should take no more than 15-20 minutes to complete and the results will be kept anonymous. If you choose not to fill out the survey you may choose cancel at any time and the results of your survey will not be included.

By submitting the survey to the researcher, you indicate your consent to use the answers provided for this research. Any question you have may be directed to either Dr. Van Cooley at 616-387-3891, James Brown 616-328-1215, the Human Subjects Institutional Review Board 616-387-8293, or the vice president for research at 616-387-8298.

This consent document has been approved for use for one year by the Human Subjects Institutional Review Board and should not be completed if the current date exceeds the approved survey date by one year.

Date

Appendix D

Computer Email Invitation to Participate in the Online Survey

My name is James Brown and I am pursuing my doctorate in educational leadership at Western Michigan University from the department of teaching, learning, and leadership. At the present time, I am conducting research for my dissertation, which is entitled, Supporting teachers using technology: Understanding teachers' perceptions of technology professional development. I would be very interested in your perspectives regarding important issues concerning technology professional development in the teaching environment and would like to invite you to participate in a short survey. I believe that what your perspectives on this issue could make a real contribution to increased understanding about technology professional development is designed and delivered to help meet the technology needs of teachers.

You may select the following link to complete this short survey. The web site that you access has been specifically designed to collect data for this survey and is maintained by Western Michigan University. It is a secure site and no personal information will be collected so as to ensure complete anonymity. You will first be asked to read an Anonymous Survey Consent prior to proceeding to the actual survey. You may of course continue and complete the survey, or discontinue the process at any time.

In addition to the survey, I will be conducting interviews regarding technology professional development issues, and I am seeking volunteers to participate in this process. Each interview will meet only one time and will last approximately one hour. If you are interested in participating, please respond to this email with your name, school system you are with, and a phone number so that I may contact you with further information. Your response to this email will be known only to me. If you prefer to contact me personally you are welcome to call me at 691-7743 which is my home telephone number.

Thank you for your participation in this important research project.

Sincerely,
James Brown
http://homepages.wmich.edu/~j5brown/>

Appendix E

Phone Script

Participant Phone Contact Script

Hello [name]. I gather you received information about my study and are interested in the possibility of participating in my research for my dissertation, which is called Supporting teachers using technology: Understanding teachers' perceptions of technology professional development. If it's okay with you, I'd like to discuss the project further, respond to any questions you might have, and then talk about whether you are still interested in participating. I will be discussing this in detail, so please feel free to interrupt me if you would like me to slow down or if you want to ask a question. My name is James Brown, and I'm a doctoral student in Educational Leadership at Western Michigan University. The purpose of my research is to investigate technology professional development in the public k-12 school system to better understand the perceptions teachers have regarding what is most important when considering technology professional development, and also what they feel may be barriers to the process. The interview will consist of a single meeting that will last approximately one hour. A series of eight to ten questions will be posed during this interview. All of the questions are designed to understand your personal perceptions regarding technology professional development and the role of technology in the classroom. I will not ask you to directly reveal issues about the school where you are teaching. All references to your school and the use of your name will be removed from any transcript of the session. Your confidentiality will be strictly protected. You will read a consent statement at the start of the interview, which we can also discuss. You are free to agree or disagree to participate. If you agree, I will then invite you to sign the consent document and to keep a copy for yourself. Should you choose to participate, you are also free to withdraw from this research at any time. At the conclusion of this phone contact, if you say that you wish to participate in my research, I will invite you to participate in a interview at a time and location most convenient for you. I would like to express my appreciation again for your willingness to inquire about this research. I am enthusiastic about the potential contribution this research can make to understanding the complexities of technology professional development for k-12 teachers. I hope I've explained this research clearly in this brief description. If you have any questions, I'd be happy to answer them at this time [a pause occurs, while questions are answered]. If not, I would like to invite you to tell me if you have understood my description of this research, and if you are interested in participating.

[Assuming that the potential participant has expressed their interest in participating, I would then say the following]:

Thank you. At this time, I'd like discuss the date and time for this interview.

Appendix F

Interview Questions

1) Tell me about yourself as a teacher. What is your teaching history and what you are doing currently. How long have you been teaching and in what areas. What is your educational background

2) Tell me about the kinds of activities you use a computer for within your classroom. How do your students use computers for your classes during the day?

3) Imagine you are sitting in your classroom and you have an idea about how to incorporate the use of computers into instruction but you are not sure how to do it. Tell me how you go about resolving this dilemma.

4) Tell me about your experience of taking what was presented during a Technology Professional Development session and integrating into your daily classroom experience.

5) Think back to your best experience attending a technology professional development session. Tell me about what made this a good experience.

6) Think back to your worst experience attending a technology professional development session. Tell me about what made this a challenging experience.

7) You have told me about your teaching background. Now I would like to hear a little bit about your experience as a computer user and how you would assess your skill level.

8) Potential follow-up: What do you believe has contributed most to your abilities as a computer user?

9) You have been given the opportunity to design the next technology professional development session. Tell me about some of the key factors that you will consider during this process.

10) Throughout the interview I have sought to understand your experience as a teacher using computer in the classroom, and the role that technology professional development may play in your experience. Is there anything about your personal experience using a computer in a classroom environment that we haven't discussed that you feel is important for others to hear?

Appendix G

Human Subjects Institutional Review Board Letter of Approval

WESTERN MICHIGAN UNIVERSITY

Human Subjects Institutional Review Board

Centennial 1903-2003 Celebration

Date: January 8, 2003

To: Van Cooley, Principal Investigator
James Brown, Student Investigator for dissertation

From: Mary Lagerwey, Chair Mary Lagerwey

Re: HSIRB Project Number: 02-12-03

This letter will serve as confirmation that your research project entitled "Supporting Teachers Using Technology: Understanding Teachers' Perceptions of Technology Professional Development" has been **approved** under the **expedited** category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you may **only** conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: January 8, 2004

Walwood Hall, Kalamazoo, MI 49008-5456
PHONE: (269) 387-8293 FAX: (269) 387-8276

Appendix H

Informed Consent Form for Teacher Interviews

Western Michigan University
Department of: Teaching Learning and Leadership
Principal Investigator: Dr. Van Cooley
Student Investigator: James Brown

You have been invited to participate in a research project entitled "Supporting teachers using technology: Understanding teachers' perceptions of technology professional development". This research is intended to study teachers' perceptions of technology professional development . This project is *James Brown's* doctoral dissertation project.

You will be asked to attend a one-hour interview with *James Brown.* You will be asked to meet *James Brown* for this session at a time and location most convenient for you. The session will involve answering eight to ten questions about the role of computers in your classroom environment, and what you feel are important issues regarding technology professional development.

All of the information collected from you will be confidential. That means that your name will not appear on any papers on which this information is recorded. The interview will be recorded by audio device and the tapes used during the interview will be transcribed. Any specific reference to names or schools will be removed from the transcription. The tapes and transcriptions will be retained for at least three years in a locked file in the principal investigator's office on the campus of Western Michigan University.

You may refuse to participate or quit at any time during the study without prejudice or penalty. If you have any questions or concerns about this study, you may contact either *Dr. Van Cooley* at 269-387-3891 or *James Brown at 989-328-1215*. You may also contact the chair of Human Subjects Institutional Review Board at 269-387-8293 or the vice president for research at 269-387-8298 with any concerns that you have.

This consent document has been approved for use for one year by the Human Subjects Institutional Review Board as indicated by the stamped date and signature of the board chair in the upper right corner. Do not participate in this study if the stamped date is more than one year old.

Your signature below indicates that you have read and/or had explained to you the purpose and requirements of the study and that you agree to participate.

_____ _____

Signature Date

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