Teachers' perceptions of technology professional development in a suburban school district

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TEACHERS' PERCEPTIONS OF TECHNOLOGY PROFESSIONAL DEVELOPMENT IN A SUBURBAN SCHOOL DISTRICT

by

Victoria A. Kaspar

A DISSERTATION

Presented to the Faculty of

The Graduate College at the University of Nebraska at Omaha

In Partial Fulfillment of Requirements

For the Degree of Doctor of Education

Major: Educational Administration

Under the Supervision of Dr. Laura Schulte

Omaha, Nebraska

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DISSERTATION TITLE

Teachers' Perception of Technology Professional Development in a Suburban School District

BY

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Millions of dollars are spent nationally on school technology and teacher technology professional development, yet many teachers perceive the training to be a waste of time and money. This could be due to the types of teacher technology professional development, the instructional delivery methods, or the follow-up support that the teachers receive.

The purpose of this survey study was to explore teachers’ perceptions of technology professional development. Data were gathered by using an online survey sent out electronically to randomly selected teachers in a suburban school district. Statistically significant differences in teacher’s perceptions of technology professional development were found between middle and high school teachers and among the teachers with varied technology experience. Some of the other demographic variables studied included age, gender, school subject taught, years of teaching experience, and technology course topic.

The results of this study provide additional information about effective teacher technology professional development. The findings may have implications for improved teachers professional development practices in the suburban school district and elsewhere.
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Chapter 1

Introduction

Millions of dollars are spent nationally on school technology and teacher technology professional development, yet many teachers perceive the training to be a waste of time and money. This could be due to the types of teacher technology professional development, the instructional delivery methods, or the follow-up support that the teachers receive.

The National Professional Development Council did a 2-year study examining 500 teacher professional development programs and selected only 26 as exemplary based on their four agreed-upon criteria:

...[R]esults measurable in terms of student performance, a well-defined process that enables others to replicate the learning, content-specific professional development designed to improve teachers’ content knowledge and pedagogical skills, [and] involvement of multiple schools, within or across districts, a state, or a region. (Hirsh, 2000, p. 50)

Fragmented, single-session professional development does not meet the needs of adult learners but continues to be rampant in American schools.

Fullan (1991) recalls the reasons that he gave in 1979 for professional development failure: one-shot experiences, topics selected by other than the intended audience, no follow-up support or evaluation, no recognition for the individual needs of schools, and lack of conceptual planning at the onset. Often it does not work because the designer failed to take into account change process research. Professional
development is at the heart of any reform or change (Spark & Hirsh, 1997). If the change works, the results are professional growth, mastery, and a sense of accomplishment (Fullan, 1991). Resistance to change must be understood before the onset of any new training. Change "...provokes loss, challenges competence, creates confusion, and causes conflict" (Evans, 1996, p. 21), so that many "...exalt it in principle [but]...oppose it in practice" (p. 25). Technology and constant change are synonyms. Trying to keep up with technological changes can create feelings of teacher incompetence. Competition for technology purchase or replacement funds creates conflict inside school buildings, within districts, and within states.

Teacher technology use presents problems in that it is difficult for school districts to afford keeping up with new hardware and software. Computers become outdated so quickly, and software updates often require more training. To infuse technology into instruction, the teacher must first understand how and when to use it. When the teacher is the learner, adult learning theory suggests that the course should provide some self-direction, branching, and the capability to skip sections. The course should also meet the needs of various learning styles (Fidishun, 2002; Knowles, Holton, & Swanson, 1998). Little first-hand research has been done on teacher technology professional development programs to see if they meet the needs of the adult professional learners.

Purpose Statement

The purpose of this survey study was to explore teachers' perceptions of technology professional development.
Research Questions

The following research questions were drawn from the literature and were used to guide the study:

1. What are teachers’ perceptions of technology professional development? (Perceptions)

2. Does gender affect teachers’ perceptions of technology professional development? (Gender)

3. Does age affect teachers’ perceptions of technology professional development? (Age)

4. Does grade level taught affect teachers’ perceptions of technology professional development? (Grade level)

5. Does the number of years of experience affect teachers’ perceptions of technology professional development? (Years of experience)

6. Does subject area taught affect teachers’ perceptions of technology professional development? (Subject area taught)

7. Does the type of delivery method (traditional, independent, or online) affect teachers’ perceptions of technology professional development? (Delivery method)

8. Does the course content affect teachers’ perceptions of technology professional development? (Course content)

9. Does experience with technology affect teachers’ perceptions of technology professional development? (Technology experience)

Theoretical Framework

The adult learning theory called andragogy provides the theoretical framework for this study. It comes from two Greek words, “andra”, which means man (Lexicon Webster, 1977) and “agogos” which means leading. It is similar to a term more familiar to educators, pedagogy, which comes from two Greek words meaning child “paid” and leading “agogos” (“Moving”, 2002). Although some researchers can trace andragogy
back to German educators who used it to describe Plato's theories, it was popularized by Knowles in a 1968 article and then books he later wrote on the topic of adult education (Fidishun, 2002).

Knowles focused on four assumptions about adults as learners: (a) their adult self-concept makes them self-directed, (b) learning can be built upon their varied experiences, (c) their social roles create a readiness to learn, and (d) they expect new learning to be performance-centered and immediately useful to them (Knowles et al., 1998; "Moving", 2002). Knowles' later writing in 1998 with Holton and Swanson expanded andragogy to six assumptions: "...[T]he adult learner's need to know, the adult learner's self concept, the role of the adult learner's experience, the adult learner's readiness to learn, the adult learner's orientation to learning, and the adult learner's motivation to learn" (Fidishun, 2002, pp. 2-4).

This study was seeking to determine if the assumptions of andragogy hypothesized by Knowles apply to teachers' technology professional development. If these assumptions are applicable, school districts could improve teachers' technology professional development experiences by honoring teachers as independent, ready learners who come to the classes with applicable experiences and are expecting practical, performance-based ideas.

Assumptions

Two assumptions from the review of the literature were a foundation for this survey study. The first one was that teachers' technology professional development, and all professional development, needs to be useful. Teachers need to return to the
classroom having learned something that they can apply in their lesson plans. The second assumption was that follow-up support is required for teachers' technology professional development. This follow-up support can amount to having the necessary hardware or software back at the school building to make use of the new skills or having the personnel support to troubleshoot or help the teacher infuse the new skills into lessons for the students.

**Limitations**

There were three possible limitations to the survey study. Teachers' perceptions of the required technology professional development may be impacted by intangibles such as their desire to be present at the training and interest in the topic. The second possible limitation was that of the course selection. The teachers' first and second choice of courses may have been full at their preferred time. The third possible limitation was that the researcher may have had a bias, as she, being a certificated professional member in the suburban district, must also participate in the technology flex program. That might have affected data interpretation.

**Delimitations**

There were two delimitations to this survey study. One was that the study included only a random sample of teachers from one large suburban school district. The second was that the study focused only on technology professional development. One third of the district's teachers were involved in differentiated instruction training during this survey study, some in peer coaching, while the rest were involved in the
technology professional development called “technology flex”. The random sample was drawn from this last group.

**Definition of Terms**

**Andragogy** is “...a system of ideas, concepts, and approaches to adult learning [that] was introduced to adult educators in the United States by Malcolm Knowles” (“Moving”, 2002, p.1).

**Teacher professional development** is the ongoing course work that a district or state requires of a teacher to keep his or her professional status once the teacher has his or her certification. It could include graduate courses or workshops.

**Teacher technology professional development** is coursework either on computer systems, hardware, or software use that a teacher takes to improve his or her use of technology for instructional and managerial reasons. This training could be for graduate credit or workshops and could be required by the teacher’s school district.

**Educational technology** is any hardware or software used for instructional purposes or teacher classroom management.

**Educational hardware** includes the computer hard drives, monitors, keyboards, printers, modems, zip or CD drives, CD burners, or scanners. It could also include projection systems, video editing equipment, or hand-held computers.

**Educational software** includes programs for word processing, spreadsheets, databases, slide shows, image scanning, video editing, grade books, attendance, or internet searches. It could include CDs for textbooks that contain supplemental materials, tests, and quizzes.
Teacher classroom management involves the processes a teacher does to run his or her classroom smoothly, such as making lesson plans, doing seating charts, keeping a grade book, keeping attendance records, logging parent contacts, or keeping student records. Many of these processes can be completed electronically using technology.

Equipment support after technology professional development means that the teacher has the hardware and software back in his or her building to support the new skills he or she learned at the technology professional development class or workshop.

Personnel support after technology professional development means that the teacher has someone in the building or a district person to contact for troubleshooting help with the new skills learned, whether the skills have to do with hardware or software.

Curriculum support after technology professional development includes personnel support for the teacher with ideas to infuse the new skill into the regular curriculum delivery, provided either by the building or the school district.

Technology “flex” program is a required part of a 3-year professional development cycle by a suburban district in Nebraska. One of the 3 years is devoted to differentiated instruction and the other 2 are for technology training. The teacher is required to take an 8-hour technology workshop and is paid at his or her per diem rate for the 8 hours. The choices include online courses though Element K and a variety of workshops offered at various building sites after school hours or during vacation days. A waiver could also be obtained from the district director of professional development for an independent project or for a graduate course in technology.
Online technology professional development means that the teacher acting as a technology student uses a computer to take a structured course to improve his or her use of technology. One example was the online account through Element K. The teacher has a district teacher-coach to help him or her start. The teacher selects two courses of study that take approximately 8 hours to complete. Choices include systems courses in Windows and Novell, and software courses in Internet Explorer, Excel, PowerPoint, Word, Dream Weaver, and File Maker Pro. The teacher goes to the Element K web site after school hours and does the lessons at his or her own pace. The results are sent electronically to the district when the courses are completed.

In-class technology professional development means that the teacher signs up for a traditional workshop in technology that is held in a district or building computer lab. The teacher receives direct instruction, modeling, and hands-on help from the instructor. The topics vary, including systems, software, and hardware use.

Technology professional development waiver means that the teacher applies to the district director of professional development to do an independent study or take a graduate-level technology course at a local university. Examples of reasons for waivers include the teacher’s desire to learn new software or hardware not offered via district courses, or the teacher’s technology skills are extremely advanced so that they are teaching the technology flex courses or are Element K coaches. These teachers are included in the survey.

Suburban school district is defined as a school district from an area attached to or by a city with 150,000 people or more.
Significance of Study

Significance to research. There are few research studies about teachers’ perceptions of technology professional development. Most computer-research Likert surveys listed in ERIC were created in the mid-to-late 1980s. There are few studies that disaggregate the information by gender, age, grade level, subject taught, years of experience, course delivery method, course content, or technology experience.

Significance to practice. Improved courses for teacher technology professional development may come out of this study. Improved follow-up support for teacher technology professional development may be a result of this survey study.

Outline of the Study

Chapter 2 presents a review of literature about teacher professional development and new trends, teacher classroom use of technology, and teacher technology professional development. Chapter 3 describes the design of the survey study. It describes the methodology and steps taken to gather and analyze the data. Chapter 4 presents the research analyses and findings that came from the study. Chapter 5, the final chapter, contains a summary of the study and findings, the conclusions drawn, and the implications.
Chapter 2  

Review of the Literature  

The purposes of this literature review are to examine old and new practices in professional development, examine teacher technology use, and explore teacher technology professional development. While most of the research was taken from K-12 education, some research from higher education is applicable within the framework of teachers as adult learners. Knowles et al. (1998) contend that the assumptions of andragogy, hypothesized by Knowles as early as 1980, have wide application because andragogy is a transactional model. "Therein lies the strength of andragogy: it is a set of core adult learning principals that apply to all adult learning situations" (p. 2). The adult learners for this literature review are teachers.  

Teacher Professional Development  

Most teachers want their students to become lifelong learners, but students need to see this modeled by their teachers. The old adage of actions speaking louder than words applies here. As our global economy with its technological and scientific advances forces students to be lifelong learners to keep up with societal changes, so too teachers have multiple issues and trends impacting their workplaces and professional lives that force them to stay current.  

The number of areas where teachers need to keep current is staggering. Depending on the age and experience of the teacher, some or all of these may be issues or topics for professional development: classroom management and discipline; school safety; integration of technology into curriculum; integration of technology used for
teacher professional time-management; new instructional techniques; and district, state, and federal curriculum changes. Teachers also see training in implementation of state and national standards, brain research and multiple intelligences, the change process, school restructuring and reculturing efforts, scheduling changes, mentoring and peer coaching, special education law changes, multicultural issues, high-ability learners, differentiation of instruction, sexual harassment prevention, site-based management for teachers as leaders, action research, school-to-work and internships, and inclusion. Is it any wonder teachers feel that their professional development takes the form of a Whitman sampler, a bite here and there but nothing of substance? Professional development should be a series of processes, not isolated events (Guskey, 1995).

**Historical Problems with Professional Development**

The National Staff Development Council worked through a grant for 2 years examining 500 professional development programs and selected only 26 as exemplary based on their four agreed upon criteria:

...[R]esults measurable in terms of student performance, a well-defined process that enables others to replicate the learning, content-specific professional development designed to improve teacher’s content knowledge and pedagogical skills, [and] involvement of multiple schools, within or across districts, a state, or a region. (Hirsh, 2000, p. 50)

The researchers planned that the study would be replicated for high schools. In the meantime, fragmented, discrete professional development that is not tied to student
achievement and does not meet the needs of adult learners continues to be rampant in American schools.

As early as the 1970s, researchers were saying these isolated professional development workshops were not working, yet little has changed over the last three decades. One turning point in the 1970s was the Concerns-Based Adoption Model, or CBAM, that gathered information about change applied to professional development. The authors of CBAM found that change is a process, with the individual as the key focus, since change is highly personal. Change often has ripple effects into other areas of school culture (Loucks-Horsley & Stiegelbauer, 1991). McLaughlin (1991) saw professional development as a key part of change since the 1970s, but it was mostly on teacher volunteered time and was not designed to have an impact on the classroom. McLaughlin studied in-depth the Rand Change Agent Study, which found that teachers relied on motivation and commitment to come from the district, not intrinsic motivation. Teachers put their initiative and commitment towards innovations that their district was taking seriously. Ongoing support from project specialists was more valuable than support from outside consultants for a brief time. Having the support of the principal was also key to any lasting progress, as he or she was the broker for opportunities. Both department chairpersons and principals help set the norms for acceptance of professional development in high schools. The professional development opportunities best accepted were both concrete and intensive. Teachers with new information do not always use it or keep innovation going. Teaching is “co-constructed” by its nature in that it is related to content and the needs of the learners in a “now-ness”. The classroom
is a very dynamic, inconstant place because teaching is situational and constructed daily. Sometimes just the innovation itself becomes the focus and it backfires (McLaughlin, 1991). Many of these historical problems are still standard practices that continue to persist.

Professional development has taken the form of university course work; in-house workshops; requirements for points or courses over a certain number of years; required classes for certification or recertification; or local, regional, or national conventions. It has been the expert (from over 50 miles away) who comes in for a day to present a new way of doing something. The problem with past practices for professional development is that teachers did not have a chance to practice the new technique, think about how they could use it, try it out in a risk-free way, or talk to peers about how they made it work or not work, with critical reflection along the way. Very little of the new learning actually became common practice. Ideas were criticized for being the latest bandwagon to be on, and before any innovation was truly integrated, the discipline, district, or state would be off on a tangent towards something new.

Another high school problem has been lack of collaboration role models. In study after study of excellence in professional development, elementary building studies are cited (Fullan, 1991; King & Newmann, 2000; Richardson, 2000; Sparks & Hirsh, 1997). The culture of an elementary building lends itself to more collaboration than a high school building. In an elementary building, one finds a smaller group of teachers who tend to teach multiple subjects or even multiple grades, with a principal who probably swings through the classrooms multiple times during a given day or week.
Even with the differences between elementary schools and high schools, all teachers as adult learners have some things in common.

Teachers see few rewards for continuous development when it is not the norm, and there are few penalties for not participating in it. Working in isolation, most teachers teach and learn what they choose, so professional development mirrors the classroom. Many teachers form a demanding and indifferent audience to district professional development measures. Most teachers do not see any connection between evaluation and professional growth (Little, 1990). There are also few professional development links to the community's resources. Fullan (1991) recalls the reasons that he gave in 1979 for professional development failure: one-shot experiences, topics selected by other than the intended audience, no follow-up support or evaluation, no recognition for the individual needs of schools, and lack of conceptual planning at the onset. Often training does not work because the designer failed to take into account change process research.

Lack of funding is also an issue. Typical school districts only spend about 1% of their budgets on professional development (Sparks & Hirsh, 2000). Corporate America routinely spends at least 5% of its managers' time on training, time from the regular workdays (Evans, 1996). A 1998 report from the National Center for Educational Statistics showed less than half of the teachers surveyed were given release time for professional growth, and 23% said they were given no time, support, or credit for it. There is no incentive to improve student performance when teachers are given credit on the salary scale for taking any class that many times is not linked to student
needs or school-wide goals (Sparks & Hirsh, 2000). These issues do not address educators as professionals who need ongoing training as adult learners.

**Teachers as Adult Learners with Special Needs**

Little of what has been researched as good practice with student learners has been applied to adults (Fessler & Christensen, 1992). Many universals of good pedagogy apply to adult learners also, such as connecting to previous learning, modeling, guided practice, inquiry, and reflection on new learning. Depending on the teacher’s career stage or chronological age, the teacher-as-learner has many different needs that have not been met by professional developers.

Fessler (1995) describes the teacher career stages as the following: pre-service, induction, competency building, enthusiastic and growing, career frustration, career stability, career wind-down and career exit, with not all teachers going through all stages. Where a teacher places in the teacher career-cycle is influenced also by the teacher’s personal environment, such as family or life stage, and also the organizational environment, such as management style or union affiliation. Those teachers who expressed the most satisfaction in the later career stages had selected role changes for themselves, had a close group of cohorts, and felt they achieved results in the classroom (Fessler, 1995). Professional development can influence at least two out of three of these factors by creating a community of learners and helping teachers see results with student achievement driven initiatives.

Further research has found that teachers during induction seem to need individualized and practical ideas and can benefit from a peer group and peer coaching.
In the enthusiastic and growing stage, teachers have self-imposed demands with a desire to improve. They can benefit from being mentors, being peer coaches, and being part of collaborative school improvement efforts. Teachers in the career frustration stage can be burnt out or disillusioned and perhaps need some training to re-polish their skills. Teachers in this group need recognition focused on personal and professional effectiveness rather than the time, money, or professional activity preferred by teachers at other stages. The career stability stage has to do with a "fair day's work for a fair day's pay", with spurts of both commitment and disengagement. Those interviewed asked for more time to visit and interact with peers or sabbatical time, though their needs varied greatly. They often serve as mentors or coaches. This teacher career cycle model and inventory can be a tool to design and improve professional development (Fessler & Christensen, 1992).

First year teachers in Burden's study from 1982 listed disciplining, student and parent relationship-building, becoming part of the school culture, and becoming a good teacher in their own eyes as some concerns that could be addressed through professional development. Many teachers with between 4 to 20 years of experience changed focus from themselves to larger school issues. They saw committee work as a productive way to use in-service time (Fessler & Christensen, 1992).

Teacher style is highly personalized, as many consider teaching both an art and a science. These are parts of the social realities of teaching as it is a live performance. Many think of teachers as crafts people. Teachers value their connections to individual students and take their rewards from the interactions. Teachers do their best so that
their students will learn, but often it is like a blind faith that students will learn. There is no consensus about what is basic to the profession. The goals of education are vague and conflicting. Control precedes instruction, and often all that is known about a teacher in her own building is whether she controls her classroom. Privacy, practicality, and isolation have been norms in the past (Lieberman & Miller, 1991). Professional development studies cited in Lieberman and Miller, such as Little and Rosenholtz, reflect the changing face of teaching. Little’s study of six urban schools showed professional development activities moving towards colleagues solving problems together, with administrative participation. Rosenholtz’s research about school as a workplace favored a “learning enriched” environment for the children and the professional educators. Huberman (as cited in Lieberman & Miller, 1991) found that many teachers still view themselves as independent artisans, so researchers encourage schools to strike the balance between the individual nature of teaching and the benefits from a community of learners.

Some teachers take away new professional development information and use it in a very mechanical or cookbook fashion. Teachers have to take risks with the new techniques and need a supportive climate. Even experienced teachers may not be as competent at first with new strategies and may even forget their strong teaching-technique base. Experienced teachers can become frustrated with innovations, a shift that makes them a novice again. As a consequence, teachers may abandon the new, especially when the new and prior knowledge clash. Teachers need differentiated
support through mentors or peer coaches to survive the implementation dip (Mevarech, 1995).

Each classroom has a dynamic individuality. In high school, this means five to seven dynamic individual groups to interact with daily. Teachers are change agents every day in the classroom and are in the change business (Fullan, 1995). However, too much change overwhelms. Often change, and the professional development that accompanies it, means loss.

Professional Development and Change Are Inseparable

Professional development is at the heart of any reform or change (Sparks & Hirsh, 1997). If the change works out, the results are professional growth, mastery, and a sense of accomplishment (Fullan, 1991). Resistance to change must be understood before the onset of any new training. Change “provokes loss, challenges competence, creates confusion, and causes conflict” so that many “exalt it in principle [but]…oppose it in practice” (Evans, 1996, p. 25). Even those who want to change are influenced by the culture not to do so, and even a bad culture is better than the unpredictability of change. Consequently, innovations are never perfect and never wholly implemented (Evans, 1996).

Change may imply that what is currently being done is not good enough. There are so many layers to teaching: classroom management; curricular expertise; knowledge and application of school policies; district and state expectations; classroom climate; rapport with students, parents, and colleagues; and appropriate delivery techniques, to name a few. If in the past, ACT scores and the number of college scholarships have
been the benchmarks of good teaching in high schools, the experienced teacher may be reluctant to give up what has worked. Change on the high school level can take as long as 6 years (Fullan, 2000). First order changes have more to do with efficiency about what is already done, but second order changes have to do goals, structures, and roles, and these are much more difficult and often fail. All real change involves loss, anxiety, and struggle. Change in practice has multiple dimensions, with materials, techniques, role behaviors, and beliefs (Fullan, 1991).

Teachers who have an already high sense of efficacy are the most likely to seek out change and professional development with a high degree of teacher involvement (McLaughlin, 1991). Change starts with the smallest unit, the teacher, but needs a mix of organizational and individual processes. Change best takes place when teamwork is used, linked to established norms in a continuous improvement model that fosters experimentation. The teams share perspectives and work towards solutions to common problems (Guskey, 1995). Administrators and central office people need to remember that few will accept the losses and problems associated with change unless the change is meaningful to them (Evans, 1996).

The NEA Mastery in Learning Project (MIL) of 1985 was an improvement project lead by teachers at their 26 schools. The faculty inventory had three simple but dynamic questions: “What is so wonderful about your school that you would not want to change it? What is wrong with the school that everyone knows and should be changed immediately? What is wrong, but we don’t know how to fix it?” (McClure,
1991, p. 226). This is a practical example of teachers using simple questions to guide their work as change agents in solving common problems.

For change to happen, unfreezing needs to take place, especially when a teacher is giving lip service to the change but not practicing it (Evans, 1996). Resistance to change through professional development can be eased with these tips:

“...[A]cknowledge change as a process; empower and encourage all stakeholders; set concrete goals; show sensitivity; model process skills; develop strategies for dealing with emotions; manage conflict; communicate, and monitor process dynamics” (Janus, 1999, p. 4). Once some of the resistance to change is overcome, the professional development can begin.

New Trends in Professional Development

As the complexity of schools and society increases, so does the need for educators to keep current on all the topics and issues listed in the introduction. School districts are coping with this dilemma in many ways. Many are still having the required professional development by demanding that all professional members attend a certain workshop or speaker. Some are having excellence fairs, where teachers can showcase and share their expertise with colleagues. Many are still requiring a certain number of classes to be taken in a certain number of years, but are trying to expand the offerings. In the area of technology, learning online with purchased programs and district coaches is being tried in addition to regular offered classes. More and more, districts are realizing that professional development means time to collaborate, and professional
development needs to foster reculturing and the creation of professional learning communities.

The role of the professional developer is changing too. In the 1970s, professional developers were trainers and coordinators of the training sessions. In the 1980s, the role shifted to organizational tasks, improvement initiatives, and whole system innovations. In the 1990s and early 2000s, the role shifted to fostering learning communities. Professional developers must design training, be good coaches, provide resources, manage problems, serve as consultants, be task masters, facilitate processes, and be change catalysts (Killion & Harrison, 1997). The new roles of professional developers are change agents, facilitators, and mentors (Cooper, 1991).

In addition to the role of the professional developer changing, school issues are changing. Results-driven education, systems thinking, and constructivism are changing schools and the professional training in them. “Seat time” for K-12 education and professional development were seen as adequate before, but not now. Results are expected in student performance, and professional development aimed at building specific needs that are job-embedded fills this gap if the courses are aligned with district visions. For systems thinking, both Senge and Fullan (as cited in Sparks & Hirsh, 1997) are credited with ideas that force schools to look at their structures interacting in relation to professional development to eliminate the piecemeal jobs from the past.

One case study by The North Central Regional Laboratory compared business’ and school districts’ methods. The results found that professional training must be aligned with the schools’ or business’s goals (Laine, 2000). Deming in 1986 said that...
94% of the problems in organizations come from structures and processes, not employees' performances. Strategic plans are a key factor in organizations setting these goals. Additionally, constructivism in the classroom and in professional development helps the learner look for meaning, ask questions responsibly, and feel comfortable with some uncertainty. Teachers could engage in action research, collaboration, or journal and dialog reflection groups. The larger context focus is more on teachers' learning needs, led by teachers rather than outside experts, and often very content specific. Professional development has moved from being a frill to a necessity (Sparks & Hirsh, 1997).

School capacity is the overall effectiveness of a school at addressing student achievement. Three school capacity factors that can be impacted by professional development are the teachers' knowledge and skills, the professional community, and the coherence of programs. Traditional professional development has only paid attention to teachers' knowledge and skills, which is why it has so often failed. Teachers need to use their individual talents and skills to move the collective school work forward and advance the school's capacity. The conditions that affect teacher learning are as follows: the professional development is in context with what teachers teach, sustained time is given, collaboration with peers is a part of the training, and teachers have influence over the process and substance (King & Newmann, 2000). Professional development needs to be ongoing, subject specific, and site specific (McLaughlin, 1991).
The National Staff Development Council (NSDC) recommends that school districts do the following: hold superintendents and principals, as well as teachers, accountable for student achievement in their performance evaluations; invest at least 10% of the budget in teacher learning; make sure school improvement plans focus on student achievement; embed opportunities in the teachers' day; involve all of them in a continuous way; and teach action research skills. They would like to see a national center for professional development started by the U.S. Department of Education and housed in the Office of Education Research and Improvement. Its purposes would be to monitor and disseminate research as a clearinghouse for district and states (Sparks & Hirsh, 2000).

A National Center for Education Statistics study of teacher preparation and professional development showed that public school teachers participated in the following professional development activities in 1999-2000: district curriculum or performance standards, technology integration, in-depth studies of the subject they teach, new teaching methods, student performance assessment, needs of the disabled, discipline, and diverse cultural backgrounds. Most teachers reported spending about 8 hours in the past year on one or more of these activities (Parsad, Lewis, & Farris, 2001).

Some myths in professional development still exist: more is better; new must be better than old; needs assessments are always correct; and local planning is best. Anything new must be examined with a professional and critical eye. Some needs assessments are really just "wants." Joint planning is always best for professional
development so that the big picture is considered, but the work is personalized for individual schools (Guskey, 1999).

Professional development equals time. Professional development needs to be a day-to-day part of the educators’ lives to keep them linked to a continuous improvement cycle (Darling-Hammond, 1999; Laine, 2000; Little, 1990; Richardson, 2002; Sparks & Hirsh, 1997, 2000). Teachers need time to collect data through action research, set meaningful student achievement goals, plan and assess collaboratively, peer coach, and spend time in reflection. Educators and the public need to get rid of the idea that teacher time not spent in student contact cannot raise student achievement. It can and does (Darling-Hammond, 1999). The high schools especially need to break the isolation cycle by providing more time for department articulation and also teaming with colleagues from all departments on common school goals. Efforts such as reading and study skills across the curriculum and interdepartmental courses are a tough sell at the high school level. As a part of professional development, schools should provide time for brainstorming, goal setting, self-awareness through collected evidence, observation opportunities, feedback and support (Fessler, 1995)

Professional development ideas were implemented in the classroom more when the training was held in multiple sessions more than a week apart. Small chunks spaced over time seemed more effective than 2 to 3 days at a time for change absorption and adaptation (Sparks, 1983). Time for professional development in award winning schools now means time for these: “…[T]eacher-run institutes, data collection and analysis, peer coaching, curriculum writing, collaborative lesson planning, examining
student work, action research, study groups, and a myriad of other job-embedded strategies..." (Richardson, 2000, p. 1). Job-embedded professional development ideas include study groups, action research, reflective logs, problem-solving groups, school meetings, team planning, and team teaching. The benefits of these are as follows: less time away from school, immediate application, less expensive, and matches to what we know about adults as learners (Wood & McQuarrie, 1999).

How to create the time is the problem. At the International High School in New York, interdisciplinary teams share a 70-minute planning period and have a half-day each week for professional development while clubs meet. At Central Park East Secondary School, also in New York, teachers have a full morning a week for professional development while students do community service. Hours are increased during the week so that there is a 1:00 p.m. dismissal on Fridays for weekly professional meetings (Darling-Hammond, 1999). In Wilton, Connecticut, the months of October, January, and April have no building or district meetings at all so that teachers may attend workshops embedded in their day. Teachers say that they do not miss the meetings at all. One January there were 32 offerings from which to choose (Richardson, 2000). Allowing time in the schedule is the key. This time set aside for professional development in the regular professional day lays the groundwork for schools as professional communities of learners.

Professional development equals building professional communities and reculturing schools. Schools need to foster lifelong learning for teachers by becoming professional communities of learners (Darling-Hammond, 1999; Guskey, 1995;
Richardson, 2002; Smyth, 1995; Sparks & Hirsh, 1997). Teachers having time to work in planning teams and focus on student achievement raises the bar for all students.

Fullan (1995) says teachers need four core capacities to be continuous learners: "Personal vision building, inquiry, mastery, and collaboration" (p. 255). Nias found that having a reflective community of teachers was encouraging because teachers did not feel alone in the desire to improve, where the desire to improve is not seen as a sign of being inadequate. Schools need to be culturally rewired for everyday professional development (Fullan, 1995). It is a re-norming for many schools, but especially for high schools.

High schools traditionally use departments as groups that support change in the curriculum, provide opportunities for influence in building decisions, and provide direction and encouragement for improved teaching. This also depends on the strength of the department chairperson and the political climate of the school (Johnson, 1990). If a strong department is resistant to change or innovations as its norm, this could have a negative effect when it comes to professional development for school-wide goals. High schools could use departments, interdepartmental teams, or other mixed inquiry teams as places for collaboration.

Professional development should reflect not only a teacher’s classroom skills but also a teacher’s life as a building colleague and a member of the broader community of teachers (Little, 1990). Professional development needs to be culture-building, stress teacher inquiry into practice, focus on learning for both students and professionals, and keep the balance between colleagueship and the individual craft of teaching because the
teacher makes the classroom (Lieberman & Miller, 1991). Professional development must be blended into as many activities as possible, and its goal must be continuous learning even more so than a desired innovation or change (Fullan, 1991). Schools have come up with many solutions as to how to do this.

Three ways to increase collaboration are case studies, action research, and teacher leadership roles. A practical way to open dialog is with case studies, which show teachers' knowledge embedded in the daily task of teaching. The teachers think about what they would do themselves in the situations and share strategies with their colleagues. Case studies give teachers reflective time, which they need to improve practice (Richert, 1991). For teachers to make something part of their repertoire, they may need to see as many as 15 live demonstrations or videotapes of the skill (Sparks, 1998).

Another way to engage teachers and encourage collaboration is to promote action research in schools. The steps to action research are analyzing the problem to be worked on, data collection and analysis, planning the actions, implementing the plan, and evaluating for effectiveness or modification. The data can be mostly qualitative in nature, though standardized tests can provide data that point to areas that need improvement. The ownership of the change process shifts to the teams of teachers, so the change is internalized and personalized to "hook" them and their interests (Holly, 1991).

The third idea to build learning communities is to use teachers in professional development leadership roles. More leadership roles for teachers offer these
advantages: teachers can grow without leaving the classroom, schools can develop a
culture of learning for adults and children, and schools can reduce the isolation for
teachers. The key to the third point is good communication, not only with
administration but fellow teachers, for often the teacher in the leadership position is the
only one who benefits from it. The lack of time provided for such opportunities tells
teachers that this work is not important, because schools do what schools value
(Wasley, 1991). One example in Norman, Oklahoma, uses a Professional Resource
Opportunities (PRO) program to provide 60 hours of intensive training for teachers to
go back to their building to work on school improvement measures as professional
developers and resource people. They serve 3-year elected terms, with each building
have 4 to 6 PROs at a time (Richardson, 2000). Another idea is the Teacher Center, run
by a board made up of mostly teachers who plan and design professional development
opportunities. One day a person might teach at the center; the next day he or she might
be a student (Schwartz, 1991). Peer coaching or cognitive coaching are also excellent
ways for teachers to serve as role models and leaders while building collaboration
(Schwartz, 1991; Sparks & Hirsh, 1997).

A vision for professional development must be written that makes effective use
of money and effective training of teachers. A collaborative vision must be created and
the superintendent and other administrators must communicate it. To make a more
personal ownership of professional development, more people need to be involved in
the training and learning. Ongoing professional development is necessary for anyone
who affects student performance (Richardson, 2002; Sparks & Hirsh, 1997). The best
way to become collaborative is still not clearly decided. Fullan (2000) says that even if one knows how another school became more collaborative, it does not mean that same way will work for another school. Each school must build its own model and foster ownership through participation.

**National certification as a new trend for professional development.** One recent addition to teachers’ professional development is national certification. The National Board of Professional Teaching Standards (NBPTS) was established in 1987 and is independent and non-partisan. It established five core propositions and professional teaching standards that allow teachers to earn a certificate valid for 10 years that complements state licensing in 24 fields, with 5 more in the works. The process costs about $2,000, but many scholarships and loan opportunities are available, while many districts and states pay yearly stipends to those who have earned the endorsement. In many cases, the stipend is contingent on mentoring other new candidates. Candidates must hold a bachelor’s degree, be endorsed in their state, and have taught for 3 years before applying to go through the process. Teachers are also used to evaluate the tests of the standards, yet one does not have to be certified to be an assessor (National Board of Professional Teaching Standards, n.d.a).

The NBPTS conducted two research studies in 2001, one to look at the impact of the testing on those earning certification and the other on the assessor’s perception of the benefit of being in the process. A random sample of 600 out of the 4,804 NBPTS teachers from 1994-99 was surveyed with a 41% return rate. For the assessors, 600 out of the 1,500 from the summer of 2000 were surveyed with a 42% return rate. The
nationally certified teachers reported new status and leadership roles and that they had infused new practices into their teaching (NBPTS, 2001). Of the NBPTS certified teachers, 80% thought it was better than other professional development that they had experienced. For both the NBPTS teachers and assessors surveyed, "Ninety-one percent of the NBPTSs said that the National Board Certification has positively affected their teaching practices and 83 percent said they have become more reflective about their teaching" (NBPTS, 2001, p. 2). There were 16,035 nationally certified teachers at the end of 2001, with the following states having the highest numbers: California, Florida, Mississippi, North Carolina, Ohio, and South Carolina (NBPTS, n.d.b). This program seems to have the potential to encourage better pedagogy, promote teacher recognition, leadership, and professional recommitment; all positive effects that one would expect from good professional development.

Technology as a constant challenge in professional development. Keeping current in technology creates a special professional development problem in that teachers must keep current on software and hardware, but they also must keep current on technology trends in their subject matter. Many teachers have experienced the "pinball method" of professional development for technology, where they have been allowed to learn when they are ready, and they fling from skill to skill without gaining the knowledge of how to apply the technology in the classroom to improve student achievement. Researchers suggest that priorities be set by what students need to know and be able to do, working through the National Educational Technology Standards and the American Library Association’s Information Literacy Standards. Needs
assessments should be determined through teacher surveys before professional
development is planned (Votek & Vojtek, 1999). Technology increases the need for
adults to update their skills (National Center for Educational Statistics, 2000). Teachers
use technology in a wide variety of ways in classrooms.

Teacher Technology Use

If someone began teaching 20 years ago, chances are his or her school did not
own any computers. Media use involved an opaque projector, eight-millimeter film,
projector, slide projector, and tape players. Times have certainly changed for teachers.
“The old model of instruction was predicated on information scarcity. Teachers and
their books were information oracles, spreading information to a population with few
other ways to get it” (Burness, 1997, p. 68). Now the teacher’s job is to help students
learn how to access information in ways that are constantly upgrading and changing.

In 1996, President Clinton announced the Technology Literacy Challenge with
these four focus areas:

All teachers in the nation will have the training and support they need to help
students learn to use computers and the information superhighway. All teachers
and students will have modern multimedia computers in their classrooms. Every
classroom will be connected to the information superhighway. Effective
software and online learning resources will be an integral part of every school’s
curriculum. (U.S. Department of Education, 2000, p. 3)

These are the types of programs that the funding supported: challenge grants to schools
and their business partners, a technology literacy challenge fund to help states,
preparing tomorrow’s teachers to use technology programs, community technology centers, learning anytime/anywhere distance learning grants, state technology grants, migrant education technology grants, and the E-rate subsidized funding for telecommunications for poor and rural areas. In 1995, $46,510,790 was spent nationally on these programs, while the total for the year 2000 was $2,749,140,411 (U.S. Department of Education, 2000).

There is other evidence that computer use continues to be on the rise. A National Center for Educational Statistics (NCES) report stated that in 1984, only 27% of students were using computers at school. By 1989, it jumped to 42%; by 1993, it jumped to 59%; and by 1997, it jumped to 68%. The percentage of students using computers at home went from 11% in 1984 to 45% in 1997. The percentage of students using home computers for their schoolwork jumped from 4% in 1984 to 28% in 1997. High school and college students scored much higher than younger students in computer usage at home and computer usage at home for schoolwork (Snyder, 2001).

Teachers are looking to technology organizations for leadership and guidelines. The International Society for Technology in Education (ISTE) has developed indicators of effective technology use for teachers called NETS, National Education Technology Standards. These standards evolved from 13 in 1993 to 23 standards. NETS include six categories: operations, planning, curriculum integration, assessment, productivity uses, and ethical issues. This project was funded by the U.S. Department of Education’s PT3 funds, Preparing Tomorrow’s Teachers to Use Technology, part of the No Child Left Behind legislation. The NETS charts included recommendations for pre-
service and first-year teachers that apply to experienced teachers too (ISTE, 2002). So far, 16 states are requiring pre-service and practicing teachers to meet technology standards for certification or re-certification. Many require proficiency demonstrations (Burke, 2000).

The Milkin Family Foundation, a strong supporter of teachers using technology, conducted a survey of the 50 state departments of education about technology leadership and vision, planning, resources, capacity, professional development, and data collection methods. The amounts spent on technology per student from 1995-1999 varied from $4 per student in Maine to a high of $441 in Ohio. Most states paid for technology through their general funds though some used gaming/gambling money (Milkin Family Foundation, 2000).

ISTE developed an index that can be used by districts to measure their support in four domains: equipment standards, staffing and processes, professional development, and intelligent systems. The index has four levels of district technology capability: emergent, islands, integrated, and exemplary. Under the equipment standards for exemplary, a district must have a 3 year replacement cycle, a specific district brand with exceptions for special projects, one platform and operating system, software standards, and a strict policy for the types of donated computers that are accepted. All peripherals, such as printers, scanners, digital cameras, are standardized and the full warranties are purchased (ISTE, 2001). Technology use motivates students as evidenced by better attendance rates, fewer behavior referrals, and more enrollments in advanced classes (Sparks, 1998).
Types of Technology Used

D. Gibson (2001) had the most useful list of possible classroom technology activities. He and four of his students researched possible technology activities as a class project. They put in what they wished their teachers were doing with technology. Teachers could use the internet’s search engines, satellite images and video microscopes; PowerPoint for presentations, scan pictures in PhotoShop, i-Movie and multimedia; and software to create brochures, play scripts, class newsletters, online journals, and research papers. Younger students could use drawing programs, interactive CDs for tutorials, simulation and logic games. Students could make spreadsheets for science and math, integrating pictures and graphs, simple databases, scanning photos, manipulating images, and importing images from the Internet.

Simkins, Cole, Tavalin, and Means (2002) reported on teachers’ use of a product-based multimedia approach to help students learn to integrate technology into their education. The students scanned pictures or took digital images, found video-clips and recordings, or used the Internet to gather images and sounds to put into their final product. The teacher’s role changed to that of a product manager.

In many curricular areas, teachers are finding uses for technology. Some state standards in language arts require students to select and use a variety of informational resources, including electronic, when researching topics. Students use graphing calculators in math and science as instruments of their work the way that professionals do. Teachers use computers to do simulations and virtual field trips. Teachers have lowered the grade level for which advanced concepts can be taught. Young students
publish stories on computers before their handwriting is legible. SimCale is a software program that introduces calculus in middle school (Sparks, 1998). Of the teachers surveyed for Education Week (1999), 87% said they used subject-specific software, with 62% responding that they used the software because it helped students to master the concepts, while 78% used it as a supplement. Of the teachers surveyed who search for software for their instructional purposes, 47% find it somewhat difficult to find what they need.

A professional development program called InTechnology involved 68 teachers from two Georgia middle schools. Only 10 out of the 68 teachers were trained. The purpose of the training was to help teachers use technology to improve learning and achievement. Statistically significant increases were reported by these 10 teachers in these two areas: classroom use of computers and presentation software (Sheumaker, Slate, & Onwuegbuzie, 2001). Having only 10 of the 68 teachers trained seemed to create disproportional groupings to compare, a limitation of the study.

New technologies are always around the corner. DVD drives are replacing CDs. Wireless connections are making school-uses of technology more flexible. The maker of hand-held computers, Palm Inc, sponsored a grant through the Research Center for Educational Technology at Kent State University in Ohio. Groups of teachers were provided Palms for their classes to use. Students and teachers both liked the portability of these hand-helds, but the teachers reported synchronization problems and high upkeep issues. All student work had to be backed up onto desktop computers (Crawford & Vahey, 2002). Over a million students have benefited from the Jason
Project, which combines online networks, virtual tours, and real expeditions in science. Professional development is a key factor in the project, as teachers also go on the Argonaut tours with their students (Burness, 1997).

Futurists have predicted that computers would replace textbooks. This has not happened, mostly because of hardware issues. Schools cannot afford a computer for each student, but hand-holds hold some promise with their lower cost and smaller size. A further reason that computers have not replaced textbooks is that it is often hard to use an e-book. Another futuristic prediction that had a slow start is virtual schools. Home-schooled students were a target audience, but use has not taken off (Molenda & Sullivan, 2001).

The Internet

School Internet access has been increasing in the last few years. A U.S. Department of Education report (2000) said that Internet use grew from 35% in 1993 to 96% in 1999. The increase of classrooms with the Internet grew from 3% in 1993 to 65% in 1999. The number of teachers using the Internet in teaching rose from 65% in 1998 to 85% in 2000. A different longitudinal study by the NCES and U.S. Department of Education (Kleiner & Farris, 2002) showed that more schools now use faster broadband Internet connections. The student-to-computer ratios have decreased from 12.1 to 1, down to 5.4 to 1 in 2001.

Over half of the schools surveyed by NCES (Kleiner & Farris, 2002) made sure students could access the Internet on their school computers for some after-school hours, with secondary schools more likely to make this access available. The operating
system that many of the schools were using in 2001 was Windows 98, while over 50% had Windows 95 or higher. Students with disabilities were provided adaptive hardware or software most of the time, depending on the disability. Most administrators and teachers with Internet had e-mail available to them on site.

The number of students using the Internet 6 or more hours a week has doubled since 1997. The teachers surveyed reported Internet integration in these ways: 44% accessed supplemental materials, 40% used it for more research, 29% used it for lesson planning, and 26% used it for up-to-date information in their curricular area (CEO Forum, 1999). One study surveyed 754 children between the ages of 12-17 and one parent of each student. They were selected from a PEW Internet and American Life Projects tracking interview, which is more oriented to marketing than to academic research. A large number of those interviewed said they used the Internet for schoolwork and most said it was a major source for a school project report. More than 50% had used a web site set up for their class at school (Lenhart, Simon, & Graziano, 2001).

Students interviewed for another Internet study said they used the Internet to do their schoolwork to write papers, e-mail friends for homework help, visit sites recommended by their teachers, and participate in online study groups. They used the Internet as a virtual textbook and reference library; as a tutor; study group; guidance counselor; and locker, backpack, and notebook. The students reported that there is a vast gap between the way they use the Internet at home and at school, where the school administrators set the usage levels and policies. The students surveyed felt the quality
of their Internet assignments were low and unchallenging. The main roadblocks reported were slow access at school, filters, and teachers not assigning projects that use the Internet (Levin & Arafeh, 2002).

Schools have qualified since 1996 for the Education or E-rate for technology purchases based on the income level of their communities. Under the Children's Internet Protection Act (CIPA), schools cannot qualify for E-rate without Internet filtering. In the 2001 survey, most of the schools were using filtering devices (Kleiner & Farris, 2002).

Many of the schools surveyed in 2001 had a school web site, while many schools responded that students participated in the maintenance of the site (Kleiner & Farris, 2002). A survey by the CEO Forum (1999), a collaborative group of business people and educators, showed that homepages are found on the Internet for two out of five schools surveyed. In a Pew Foundation study (Lenhart et al., 2001), a small number of students reported that they had made a web site for school projects.

**Instructional Uses for Technology**

Technology alone is like a pencil - it depends on what you do with it.

You can put hundreds of pencils in a classroom and nobody may use them.

Or they may use them to scribble or doodle - or with a good teacher, to help them compose a masterpiece, write a brilliant story, or design a rocket engine, said Fulton. (as cited in Sparks, 1998, p. 5)

The instructional uses of technology are vast and ever changing. One criticism of technology use has been that its use was for its own sake, not the curriculum's sake.
(I. Gibson, 2001). Many groups have been trying to change that. The California Technology Assistance Project or CTAP has rubrics on its web site for technology proficiency. Teachers use computers for communication and collaboration, preparation for planning, designing and implementing learning experiences, and evaluation and assessment. For communication, teachers should be able to create newsletters that integrate graphic charts and student work; correspond with other educators using e-mail, newsgroups, or list serves; and do audio/video conferencing. They need to demonstrate knowledge of privacy and copyright issues. Under the preparation rubrics, teachers need to know how to use the hardware and software, but also CD-ROMs, scanners, and digital cameras. They need to be able to maintain their systems and troubleshoot. Their lesson plans need to show that they are integrating available technology into their lessons, including appropriate use of Internet searches. They need to show this technology use meets the needs of their students' learning styles and is an excellent match to deliver the expected content. Under the evaluation and assessment rubric, the teachers need to show evidence of use of teacher productivity tools, such as an electronic grade book, attendance, and assessment records. They also need to keep a portfolio of technology-based products that their students have created (California State University, 2000).

Computers for student use in the classroom can cause changes in the classroom environment: rearranged space, altered use of time, and more chances for small group projects based on student interests (Sparks, 1998). Applying Technology to Restructuring and Learning (ATRL) was a 5-year project funded by the U.S.
Department of Education. The purpose of the project was to examine how teachers change their instructional practices as they integrate technology. Six schools from five states in the Southwest participated. Of the teachers in the ATRL study, 60% said computers have played a role in changing student assignments, and 57% said computers have changed their teaching practices. Only 30% said computers changed their room arrangement, yet these teachers all had six computers available in their classrooms, and 61% said computers changed the way they divided up class activities. The baseline data showed that 50% of the teachers used computers with students on a regular basis, but after 2 years, that grew to 75% (Heath & Ravitz, 2001).

An NCES study (Smerdon et al., 2000) showed that teachers have students do word processing or spreadsheets the most, followed by Internet searches, drills, and problem-solving. As for instructional activities, 61% of the teachers surveyed used computers for word processing and record keeping, 51% for Internet research, and 50% for drills. Fifty percent of the teachers surveyed used computers for problem-solving, 48% for CD-ROM search, 45% for multimedia projects, 43% for graphic presentations, 39% for demonstrations and simulations, and 23% for correspondence with experts.

According to an NCES report on teacher use of technology (Smerdon et al., 2000), the teachers who had computers available were more likely to use them for preparing lessons and communicating with colleagues. The teachers were less likely to use them to access best practices research or model lesson plans or to communicate with parents or students. Most teachers reported having computers in their classrooms and 95% reported having them available at their school. They were more likely to use
computers and the Internet if the computers were in their classroom. Over 60% of the teachers with computers available to them used them, but only one-third of the teachers had an Internet-connected computer in their classroom. Teachers with five or more computers in their room reported using computers more frequently in their instruction, which would seem to be a convenience issue. Many had at least one computer in their classroom, but only 10% had five or more computers in their room (Smerdon et al., 2000).

The literature shows a mixed review of technology's impact on achievement. One higher education study examined whether incorporating online discussion into a problem-based course in undergraduate physiology improved achievement. The students were randomly selected for one of the two courses, but once they were in the class, they were told that they were part of a study. The researchers compared their grades in prerequisite classes and GPAs to make sure the groups were comparable. Their final course grades were comparable, but the online group scored 15% higher on an application to a real life question. Subgroups from each class volunteered for further studies and were paid for their time, which seemed to taint the results of the study (Pelletier, Ness, & Murphy, 2001).

In another study of middle school teachers from 13 districts in Ohio, the goal was to see if math software use helped students pass their state math proficiency tests. Teacher-reported software use had increased from 3% in 1994 to 52% in 1999-2000, but 40% of the study participants reported not using it during class time. A greater number of students passed the proficiency exams who had not used the software in
class, and its use was not among the top four strategies used to help students pass. The software did make a difference for the students who had to take intervention classes in addition to their regular class to pass the exam. Ten of the 12 software packages that teachers used were recommended as correlating with the exam questions, but the software most frequently used by the teachers was not among these 12 software packages (Deubel, 2001).

The Milkin Family Foundation funded research by Schacter (1999) to examine studies on technology in education. The first was Kulik's meta-analysis of 500 individual studies about computer-based instruction. Kulik's concluded that students learn more in less time and like their classes better when computers are used. The second study was Sivin-Kachala's review of 219 research studies, which showed that students in technology-rich environments increased their achievement and self-concept. The third study was with Apple Computers Classrooms of Tomorrow (ACOT) and five school sites. When computers were used in the classroom, students appeared to use higher-order thinking skills, and the teachers changed their practices to more cooperative learning. The fourth study was West Virginia's Basic Skills/Computer Education Statewide Initiative. The students' scores rose on the Stanford 9 through the students' access and use of technology (Schacter, 1999).

The next study examined by the Milkin researcher was Harold Wenglinsky's National Study of Technology's Impact on Mathematics Achievement for fourth and eighth graders. The eighth graders who used simulation and higher thinking skills software showed math score gains up to 15 weeks above grade level. The fourth
graders only scored 3 to 5 weeks above predicted grade level scores. The sixth research report examined was the Scardamalia and Bereiter Computer Supported Intentional Learning Environment (CSILE) Studies. After 8 years of study, students scored higher on achievement tests and depth of understanding when using computers. The final study examined was the Learning and Epistemology Group at MIT, who used a LOGO program to teach fractions to younger students. It worked better than conventional methods of teaching fractions. The overall results of the 700 studies showed that students who use technology made gains in achievement as measured in a variety of ways (Schacter, 1999).

Clerical /Management Uses for Technology

Teachers use technology for a number of time-management functions and to perform clerical tasks in an efficient way. Of the teachers who responded to the Education Week (1999) survey, 26% said they used computers to prepare lessons, 35% used computers for grades, and 55% used computers for e-mail. Thirty percent of the teachers surveyed said they used computers 2-3 times a week to search the Internet. The NCES (Smerdon et al., 2000) found that 78% of public school teachers surveyed used computers at school to create instructional materials, 59% to gather information for lesson plans, and 51% for administrative record keeping.

A study of 160 elementary teachers from 11 schools in Pennsylvania divided computer usage into these categories: academic (for drills, research, and word processing); clerical/management (for grade reporting and e-mail); and advanced-use.
The results of the 6-point Likert survey showed that 92% of the teachers used computers to help out with their jobs. The teachers' attitudes towards computers showed a positive influence on all three of the above categories of academic, clerical, and advanced use, with the greatest influence on the clerical category. Macintosh computer-use showed the greatest influence on the academic category, while Windows/PC influenced the advanced-use category (Piper & Yan, 2001). Clerical computer use may well have been the introductory usage for many of the more experienced teachers.

**Barriers to Technology Use**

There are many reasons why teachers do not use technology. An NCES study (Smerdon et al., 2000) on teacher technology use showed that the most frequently reported barriers to computer use were an inadequate number of computers, lack of release time to learn, and too little instructional time to integrate computer use. These barriers changed by type of school and grade level. The groups that reported not enough computers tended to be secondary teachers, teachers in larger schools, and teachers in cities, whereas the elementary teachers and teachers in smaller or rural schools did not cite this as a great barrier. Elementary teachers were more likely to list lack of time as a barrier than secondary teachers. Teachers with more years of experience more often listed lack of release time to learn as a barrier as opposed to teachers with less experience. This made sense because the younger teachers may have a greater comfort level with technology.
Of the number of teachers who responded to Education Week's (1999) survey, 36% had no computer in their classroom. Forty-four percent had no Internet access in their classroom, which would explain why 38% said their students spend no time every week using computers in their classroom. Eighteen percent had not started using computer technology in their lessons. The reason for not using software was that there were not enough computers in the classroom. These teachers did use general productivity tools (80%), and 65% used reference products on CD. Instructional software that they would like to use but couldn't due to their hardware was a barrier for 47% of the teachers responding. Expense (48%) and ease of use (38%) were two of the biggest barriers to software use chosen by the surveyed teachers. Sixty-one percent of these teachers surveyed said they use the Internet, and of those who did not, 69% said it was because of the lack of internet-connected computers in their classroom. Of those who used the Internet, 81% used sites related to their subject area, but 42% reported it was sometimes difficult to find these sites.

Another reason that teachers gave for not using computers was the lack of technical support. The ISTE index for districts suggests that exemplary technology support should mean less than a 75:1 ratio of computers to technician. Exemplary programs also have comprehensive formulas for staffing, a helpdesk, regular technician support that is not disrupted by new equipment installment, user manuals available, technology staff that is certified (A+, Cisco, Mous), and low employee turnover with competitive salaries (International Society for Technology in Education, 2001). These things are rarely in place in schools.
One obstacle to Internet use that 80% of teachers reported in one survey was insufficient teacher training (CEO Forum, 1999). However, Baylor and Ritchie (2001) found that teacher openness to change often served as the best predictor for technology use, even though receptiveness to change is more of a personality trait. The technology impact on content was also predicted by strength of technology leadership, while the technology impact on higher order thinking skills was influenced by the levels of constructivist techniques used. Teacher technology competency and integration were best predicted by openness to change. Along with barriers to technology use, there are also differences in the users and their situations.

Differences in Teacher Technology Uses

Various teachers use technology at different rates for a number of reasons. An NCES report on teacher technology (Smerdon et al., 2000) found that elementary teachers were more likely than secondary teachers to communicate with parents using technology and have students do projects in the classroom, such as Internet searches or drills. The secondary teachers used the computers for record keeping, outside class projects, and student research on the Internet. Another difference was related to the socioeconomic status of the school. Teachers in low minority and low poverty schools used technology more, showing inequities still exist. Teachers in schools with more than 50% minority populations reported their outdated and unreliable computers were a great barrier to technology use.

Years of experience was another variable that seemed to affect technology use and course work. Teachers with 20 or more years of experience reported taking all
types of computer training at higher rates than teachers with 10-19 years of experience, 4-9 years of experience, or 3 or fewer years of teaching experience. The widest separation came from computer basics course work, with 90% of teachers with 20 or more years of experience taking that type of training, as opposed to 63% with 3 or less years experience. When it came to follow-up or advanced training, the gap lessened, with 53% of the 20+ years group and 46% of the 3 years or less experience group taking that kind of training. The teachers with less experience were more likely to use technology at home to create lesson plans and make materials, and at school used computers to search the Internet and used e-mail (Smerdon et al., 2000).

Conflicting information was reported in an Ohio math software study, which found that teaching experience was not related to software use or non-use. Teachers with 20+ years used it at the same rate as newer teachers, around 60%. Curiously enough, the 5 to 10 years of experience group used it less, at only 36% (Deubel, 2001).

An additional difference is that teachers in smaller schools reported fewer incentives such as release time and paid expenses and home Internet connection. In an NCES (Smerdon et al., 2000) teacher technology use survey, teachers reported a variety of incentives for participation in technology professional development, such as home Internet connections through the school’s network (22%), stipends (32%), release time (39%), paid expenses (40%), more classroom resources (46%), and credit for a certification process (56%). A variety of factors influenced teacher technology use.
School Technology Progress

The school’s support made a huge difference in teacher technology use. The CEO Forum (1999) STAR Report measured school progress in these four pillars outlined by Clinton’s Literacy Challenge: hardware, connectivity, digital content, and professional development. The CEO Forum is an alliance of leading corporations and educational organizations that committed to a 4-year school technology project. The student-to-computer ratio in their data went from 10:1 in 1995-96 to 7:1 in 1997-98. One of the biggest problems reported was insufficient electrical wiring to support the technology use. Concerning connectivity, public school Internet access increased from 35% in 1994 to 78% in 1997. By 1999, $760 million were distributed through the electronic E-rate funding by the federal government. The E-rate, which is a telecommunication subsidy, gave greater discounts to schools and libraries for poor and rural areas to increase Internet access.

The number of schools surveyed integrating technology effectively increased from 15% to 24% from the first STAR Report in 1997 to the STAR Year 2 Report in 1999. The percentage of schools in the low to mid technology range decreased from 85% to 76%. The number of high technology schools went up from 12% to 18% and the target technology or elite technology schools rose from 3% to 6%. For a school to be in the high technology category, the student-to-computer ratio needed to be 5:1. Of these schools, 73% had processors equal or greater than Intel 386, 90% had Internet access, and 85% had LANs. The target technology schools had a 3:1 computer ratio,
while 81% had Intel 386 or greater, and 89% had more than one LAN (CEO Forum, 1999).

**Nebraska School Technology**

The school district used in this researcher's study is in the state of Nebraska. A U.S. Department of Education (2000) study of all 50 states compiled summary data on each state. In Nebraska, $1,232,500 was spent on technology in 1995, while the figure for 2000 was up to $11,582,816. Nebraska had a 8 to 1 student-to-computer ratio, while 87% of the classrooms had at least one multimedia computer. The great majority (91%) of Nebraska schools had at least 50% of the teachers with school e-mail addresses.

Another 50 state survey, this time by the Milkin Family Foundation (2000), reported that Nebraska had online learning environments, interactive satellites, video programs, professional development centers for learning technologies, and a statewide training-the-trainer program, with 10% of that program focused on technical skills and 90% on curriculum integration. Nebraska's respondent was Dean Bergman, the Technology Center's administrator. The Nebraska Technology Commission was responsible to coordinate efforts with the government, K-12 schools, higher education schools, and communities. Nebraska had a technology master plan, developed in 1996. Nebraska technology funding in 1998 came from 30% general funds and 70% gaming funds/lottery. Twenty percent of the discretionary Technology Literacy Challenge Funds (TLCF) were spent on professional development. The state reported having regional technology centers to help with training. Nebraska does not have student standards for technology or a technology graduation requirement. Thirty-six states...
replied that they had student technology standards and nine states replied that they had technology graduation requirements. Nebraska is lagging behind in those two areas.

In another state-by-state survey of school technology by the Milkin Family Foundation (1999), technology coordinators from 27 states responded to their survey in the 1998-99 academic school year. The Nebraska data from this survey are not as valid as data from states like Nevada, which had a 100% return rate. The Nebraska data only represented a 6% district response rate and represented only 33,000 of the over 292,000 Nebraska students. Of the districts that responded in Nebraska, 88% of the students were using online research techniques, while 98% used computers either in their classroom or a lab. Students used e-mail at a rate of 90%, while 86% became more independent as a learner, and 73% said they were more engaged in a lesson using technology. Only 6% of Nebraska's school districts responding reported decreased dropout rates with increased technology use.

In addition, other information from the Milkin Family Foundation (1999) study reported that 50% of the Nebraska school districts surveyed used technology-integrated curriculum, in-class assignments produced with technology, more inquiry-based learning, adjusted lessons to meet students needs, more cooperative groups, and project-based learning. Seventy-eight percent of the teachers who responded listed technology as important in their classrooms. As for the skill level of the teachers, over 50% said they were a bit advanced on computer use, software, and the Internet, while over 74% felt comfortable with e-mail. Fifty-six percent of Nebraska teachers reported using computers for management and grades, 18% for science simulations, and 55% for
desktop publishing. The districts surveyed said their programs are evaluated yearly. Only 14% of Nebraska teachers reported using technology to track assessments, which seems to be an area needing improvement. The funding for technology came from state funds, federal funds, and district general funds. Nebraska had a small amount of funds for community use of technology and few partnerships compared to states like Nevada, with 86% partnerships with software companies. The survey responses in Nebraska noted that computers were not used because the computers were outdated (84%) or needed repair (over 50%). Nebraska had both its strengths and weaknesses when it came to technology, its schools, and teacher technology use.

Teacher Perceptions of Technology Professional Development

The No Child Left Behind Act (NCLBA) of 2001, Title IX, Part A, Section 9101, has an extensive definition of professional development:

“The term professional development (a) included activities that to the extent appropriate, provide training for teachers and principals in the use of technology so that technology and technology applications are effectively used to improve teaching and learning in the curricula and core academic subjects in which the teachers teach. (Richardson, 2002, p. 8)

The NCLBA provides states with educational block grants through a program titled Enhancing Education through Technology. The local education agencies are required to use at least 25% of their funds for professional development to help teachers integrate technology into their curriculum (U.S. Department of Education, 2002). Some professional education groups are concerned that requirements to access the
professional development funds have more access for retention/recruitment, so it may be easier to use the funds for these purposes (Richardson, 2002). States can be exempt if they show they already have a high quality program. The government consolidated the current TLCF, the technology dollars given to individual states, into this new program NCLBA (U.S. Department of Education, 2002).

In the past, only six states spent over 40% of their TLCF discretionary funds on technology professional development (Milkin Family Foundation, 2000). The National Staff Development Council (2002) in its board resolutions recommended that 30% of the technology budget be spent on professional development. There are other weaknesses in teacher technology training. Only 15 states out of 50 have pre-service teacher technology requirements. Only 3 states require administrators to meet technology requirements to renew certification, and only 4 states require teachers to meet technology-related requirements to keep their credentials (Milkin Family Foundation, 2000).

A university study on technology has relevance to K-12 education. Bielefeldt (2000) found that commitment and money helped these institutions provide the technology needed, while professional development was the best technique to help staff integrate technology. The CEO Forum (1999) survey found that about 5% of the technology budget was spent on teacher professional development. Many schools (74%) had technology skill plans for individual teachers. The U.S. Department of Education (2000) found that from 1994 to 1998, the number of teachers who participated in professional development to integrate technology into their curriculum...
rose from 51% to 78%. Students in the Pew research on Internet savvy students said that professional development and technical help were critical to help teachers use the Internet in their lessons (Levin & Arafeh, 2002). The NETS technology standards included the need for professional development in several delivery modes and time set aside to take the training. These standards advise school districts that technology assistance must be offered (ISTE, 2002).

Few studies exist that try to measure increased computer use after professional development. Heath and Ravitz (2001) noted an increase of computer use from 50% to 75% after training. The first tier of this study involved 150 teachers in a 2-year study. The teachers took 72 hours of technology and constructivism professional development. They took a previously tested Teaching, Learning, and Computing (TLC) survey and gave the researchers qualitative data such as interviews, e-mails, and computer self-assessment. The second tier of the study explored six case studies selected out of the 150 teachers. The TLC survey was compared to national probability norms from a sample of 2,251 teachers.

A framework designed to evaluate software was used by its developers to evaluate technology professional development in a longitudinal case study at John Paul College in Brisbane, Australia. McDougall and Squires (1997) used the Perspectives Interactions Paradigm with five foci: (a) skills in using particular software applications, such as hands-on workshops; (b and c) integration of IT into existing curricula and IT-related changes in curricula, supported by formal presentations and team work; (d) changes in teacher roles, such as during sharing sessions; and (e) underpinning theories
of education through keynote speakers or individual reading and reflection.

Professional development that was missing any of the foci was labeled incomplete.

Types of Technology Professional Development

There are many types of technology professional development: in a class with an instructor, online, and independent or collaborative work. The NCES teacher technology use survey asked teachers many questions about their practices. The types of courses teachers had taken were Internet use (75%), software applications (81%), basic computer training (83%), integration of technology into instruction (74%), follow-up or advanced training (55%), and use of other advanced telecommunications (53%). Half of the teachers said the follow-up classes and more advanced training were available after the initial course (Smerdon et al., 2000).

The ISTE index under domain three, professional development, listed the following items under exemplary district programs: a comprehensive technology staff development program with online training opportunities, timely organization-wide training for new software, clear staff expectations, amply trained technical staff, and basic troubleshooting taught to all (ISTE, 2001). One example is the PBS Mathline, which has a collaborative group of teachers who communicate online in groups or as mentors (Sparks, 1998).

Online professional development can be web-based or from a CD-ROM. Many districts find it less expensive and easier to schedule than traditional staff development. There are two types of web-based courses: asynchronous, offered 24 hours a day, and synchronous, requiring all people to be online at the same time. The asynchronous
instruction usually provides a broad time frame, such as 6 months, to complete and allows the student to work at his or her convenience and decide how much time will be spent on it at one time. Online courses save money that would have been used for travel, substitutes, and materials. These courses are easy to modify and do not have the large time waits for printing materials. The disadvantages, however, include the need for fast internet access, increased costs with video or audio streaming, and the cost of the initial course development, which can be 3-4 times higher than in-class training. It does not fit all learning styles either, as some people prefer having a teacher there to answer questions and assist (Killion, 2000).

A study of web-based instruction for pre-service teachers from a technical university in Turkey had mixed results (Yigit & Yildirim, 2001). The faculty in this qualitative study felt the lack of face-to-face interaction was a weakness, but the pre-service teachers liked the adjusted learning pace and thought that the web-based instruction was more suitable for adult learners. However, the students listed discussion as their favorite instructional strategy and books as a favorite medium, which both seemed very traditional. Similarly, a university study that offered a Human Resource Development class in three versions (web-based, classroom, and satellite-based) on a voluntary basis found no significant difference in perceived learning among the groups. The satellite group took the course simultaneously with the classroom group. The web-based group appreciated the self-adjusted pace, but one should remember that the student selected the choice that fit his or her learning style (Lim, 2001).
Many unique technology-related professional development ideas are available. Teachers can watch online video vignettes as a new way for staff development. InTime was developed from a U.S. Department of Education grant called Preparing Tomorrow's Teachers to Use Technology. The University of Northern Iowa was the lead institution in the Renaissance Group of five institutions. During the 3-year project, 60 teachers from 5 states helped create over 600 videos or CDs. The teachers who participated learned online video production techniques, scrolling transcripts, and database development. Sample lessons can also be accessed with teacher reflections on the lesson's effectiveness. This project was designed for pre-service teachers but also for classroom teachers, staff developers, and administrators to use for professional development (University of Northern Iowa, 2002).

A similar online source for teaching ideas is available through MERLOT, the Multimedia Educational Resource for Learning and Online Teaching. It was designed for higher education faculty, but has proven to be a great source for K-12 educators with its simulations, animation, tutorials, model lesson plans, web site collections on topics, and other references. It can be used for professional development in many ways. One example of its usefulness was an administrator suggesting that a struggling teacher use the site for teaching ideas (Powers & Barnes, 2001). A similar resource called Instructional Management System (IMS) was created by the Palm Beach County Schools to align lesson plans with the Florida State Standards. This 3-year project required enormous amounts of technology staff development to make staff comfortable using the 84 relational databases of units (Cafolla & Schoon, 2001).
Teachers often take graduate courses for professional development, and many new technology options are surfacing. Saunders (2001) described an online master’s degree program in teaching and leadership available from the University of Illinois at Springfield. The emphasis is on real-life situations using a Blackboard format. They have a mentoring program and encourage contact among students outside the online format.

Many teachers’ technology skills are self-taught through trial and error. For 58% of the respondents, teachers in the Ohio math software proficiency study reported that what they knew about computers and the math software had been learned on their own. Looking at whether the teachers were self-taught or not, there was no significant difference between those teachers who used the math software with students in their class and those who did not use the software (Deubel, 2001). Teachers surveyed in the NCES teacher technology use survey (Smerdon et al., 2000) said that independent learning was the method most frequently selected to ready teachers for technology use, with formal professional development courses coming in second. Half of them said college/graduate classes prepared them.

Few studies mentioned any differences in results between mandatory and voluntary technology staff development. In fact, many articles did not mention if the training was mandatory or voluntary, unless it was a pilot or grant study. A Scottish study concluded that their teachers’ lack of progress toward their 46 established technology competencies had to do with the fact that the training was voluntary so far. They were afraid to make it mandatory because the “technophobics” might only do a
surface, not in-depth, study (Van der Kuyl, Kirkwood, Grant, & Parton, 2001).

Whether the training was voluntary or not, teachers often had a hard time squeezing in technology training.

Amount of Time Spent

The NCES teacher technology use survey (Smerdon et al., 2000) reported that over a 3-year period, the majority of teachers participated in about 32 hours or about 4 days of technology training. Ten percent reported no training, 43% reported 1-8 hours, 34% reported 9-32 hours, and 12% reported over 32 hours of technology training. Those who spent over 9 hours reported feeling more prepared to use computers and the internet, with 32% reporting somewhat prepared and 66% reporting feeling very to well prepared. In a different NCES survey (Parsad et al., 2001), 74% of the teachers surveyed reported attending professional development with a focus on integrating technology into curriculum. Many (61%) spent 1 to 8 hours, 28% spent 9-32 hours, but only 11% spent over 32 hours on technology staff development.

On the other hand, teachers received 72 hours of staff development training in technology and constructivism methods of instruction in another study (Heath & Ravitz, 2001). Among the teachers participating in this study, 77% said these workshops influenced their teaching, and 78% said the computing opportunity and experience changed their teaching. Over half of them said the person who gives them the best ideas about teaching seems to know a lot about computers. The reasons that the teachers gave for using computers in instruction were constructivist in nature.
example, students were learning to work independently and collaboratively to discover ideas and analyze information.

Teachers in the Nebraska data results of a Milkin Family Foundation study (1999) gave their average number of hours of technology training in the past 12 months as 11.9 hours, with the lowest of the 27 states reporting at 7.4 hours and the highest 20.4 hours. Forty-one percent of Nebraska districts provided incentives for technology training, while over 80% had special workshops and over 40% had release time. Almost 80% of the districts provided additional resources for their teachers’ classrooms. Seventy-four percent of the districts responding provided teacher incentives for technology training that included travel or training expenses paid, while 38% of the districts reported using positive evaluations, recognition, discounted computers, and free software for incentives.

Comparably, in the Education Week survey (1999), 31% of the teachers answering the national survey said they had 1-5 hours of technology training (word processing, internet searching) in the past 12 months, but 27% said they had none. Equal percentages were reported for integrating technology into curriculum training, either no training and 1-5 hours in the past 12 months. The number of hours that teachers spent in technology professional development varied widely.

Feeling of Preparedness

Technology has a way of creating anxiety in some adults, even among those who use it every day. Teachers in a NCES teacher technology use survey (Smerdon et al., 2000) reported feeling prepared in relation to these computer activities: 71% felt
prepared to create instructional materials, 59% felt prepared to gather information for lesson plans, 34% felt prepared to access model lesson plans, 37% felt prepared to access research and best practices, and 36% felt prepared to do multimedia presentations. At least one-third of the teachers felt very well or well prepared to use computers and the Internet, and they were more likely to require students to use them. Teachers with less teaching experience felt more prepared than those having more experience.

For administrative and communicative purposes, public school teachers reported these feelings of preparedness: 51% felt prepared to do administrative record keeping, 50% felt prepared to communicate with colleagues, 25% felt prepared to communicate with parents, 12% felt prepared to communicate with students, and 17% felt prepared to post homework and assignments. Teachers reported feelings of preparedness to use these computer activities in their classrooms: 50% felt prepared to use practice drills, 50% felt prepared to solve problems and analyze data, 61% felt prepared to use word processing and spreadsheets, 43% felt prepared to do graphical presentations, 39% felt prepared to use demonstrations and simulations, 45% felt prepared to use multimedia projects, 48% felt prepared to use CD-ROM research, and 51% felt prepared to use internet research (Smerdon et al., 2000).

Of the teachers who responded to the Education Week survey (1999), 23% felt no better prepared to integrate technology into their classroom after their training, but the rest felt either somewhat or much better prepared. Of the teachers surveyed, 23%
did not use computers because they did not have enough training, and 35% did not use instructional software for the same reason.

Another study showed that teachers assessed themselves as intermediate users of technology, yet reported not feeling prepared to use technology. The researchers concluded that a self-evaluation is only as accurate as one’s perception, and that merely using technology does not qualify teachers as intermediate users or mean that they integrate it into instruction effectively (Ivers, 2001). On the other hand, a case study of five middle school science teachers as they integrated new technology into the curriculum found that their concerns decreased with the use of the ST(3)AIRS model, which was an acronym for these steps: “staff development, time, trainers, transition, access, involvement, recognition, and support” (Wetzel, 2001, p. 6).

Sometimes technology anxiety drives decisions. In a study of pre-service teachers taking a two-credit technology course with 21 skills assessed, everyone in the sample increased his or her skills over the 10-week course. However, their cooperating teachers were not comfortable with using the technology, on lesson plans for example, and preferred the paper methods. The researchers’ ultimate goal was to have the new teachers take a more “fearless approach” to trying new technology (Pittman & Seitz, 2001).

Support after Participation

Teachers need the kind of technical support that allows them to focus on their teaching, not the technology (Sparks, 1998). They need hardware and software-use support, integration support, and other technical advice. In the Ohio math proficiency
study, of the teachers who did not use the math software, 94% said it was due to the lack of hardware or old outdated computers. Others cited lack of training on the software. These teachers also said they had had 5 or fewer hours of training in the past year (Deubel, 2001).

In an NCES report (Smerdon et al., 2000) on teacher use of technology, public school teachers were surveyed about institutional and technical support availability and its influence as a barrier towards computer use. Whether a technology coordinator was available or not available divided the groups. Teachers without a technology coordinator saw that as a barrier to integrating technology into the curriculum 87% of the time, with 39% listing it as a great barrier.

One of the problems has to do with the lack of uniform credentials and job descriptions for the information technology (IT) professionals who help out in schools. In some schools, it is a certified teacher who is self-taught or with extra training. In other schools, it is a specialist with systems and networking training. Shoffner (2001) found that only 7 out of 50 states have a licensing process for school IT professionals, and among these states, there is no consensus for type or title of the certification. Not all agree that the person should be a certificated teacher. Of the states that license for IT, this license was separate from the library-media specialist certification. While the library/media staffing regulations and required numbers are written into most state policies, no state reported any requirement for IT staff. That leaves it up to the school districts. Among those states that do have licensing, the job responsibilities varied a
great deal. They included not only network and systems installations and troubleshooting but also integration into curriculum.

Another person in the building who is important to technology support is the principal. Lack of administrative support was listed as a barrier to some degree for 41% with a technology coordinator and 55% without, with 17% listing it as a great barrier for those without the support of a technology coordinator (Smerdon et al., 2000). In the Ohio proficiency math test study, 97% of the teachers who actually used the software reported higher administrative support (Deubel, 2001). One Midwestern qualitative study of 3 school districts concluded, “The number one issue in effective integration of educational technology into the learning environment is not the preparation of teachers for technology usage, but the presence of informed and effective leadership” (I. Gibson, 2001, p. 1). This study also recommended that administrators should provide the funds for on-site technology support, communicate needs to the district, train staff in troubleshooting, look for community technology resources, allow staff input on training topics, support risk-taking, and provide collaborative time. Administrators and teachers need to work together to make technology integration successful.

Summary

There is a history of failed educational reform, and the paradox is that the best solution is to move forward on both individual and institutional renewal at the same time (Fullan, 1991). The school, the district, and the state all need to work together to make all kinds of professional development useful and productive for the adult learner, the teacher. Teachers need support while adjusting to changes, whether it is a new
schedule or a new piece of computer software. Guskey (1997) wrote that the desire to build schools into collaborative learning communities shows promise for renewal of individual teachers in the best interest of student achievement. Research has yet to give educators all the answers about how professional development can improve student achievement for three important reasons: indicators of effectiveness have been vague, meta-analysis has looked for main effects and thrown out other important information, and quantity has won over quality. Researchers suggest that educators now find efforts that have produced demonstrable results, not just passed the “happiness hoops” of who liked the training workshop. Multiple cases should be analyzed with both quantitative and qualitative methods to gather details from multiple contexts (Guskey, 1997).

School districts need to learn how to use research data from successful professional development programs to create their own hybrid that fits their clientele and makes use of their community’s resources. Individual buildings and their districts need to work closely with their professional organizations, local universities, and the community to seek new ways to support teachers in the creation of collaborative learning communities that focus on raising achievement for all students.

Teachers need to be supported in their integration of technology into the curriculum. That support includes meaningful training, hardware and software support, and personnel support from technicians and their administrator after the training. Few studies in the research reviewed focused on the integration of new technology learning into the existing curriculum. Some of the studies compared teacher technology use by
grade level and years of experience, but fewer addressed gender or subject-taught differences.

Little first-hand research has been done on technology professional development programs for teachers to see if they meet the needs of the adult professional learners.

...[A]dults need to know why they need to learn something; adults maintain the concept of responsibility for their own decisions, their own lives; adults enter the educational activity with a greater volume and more varied experiences than children do; adults have a readiness to learn those things that they need to know in order to cope effectively with real-life situations; adults are life-centered in their orientation to learning; and, adults are more responsive to internal motivators than external motivators. (Knowles et al., 1998, p. 72)

Many teachers understand why they need to keep up with technology changes. As adults, they also need to feel in charge of their own learning in a technology course. Their previous experiences with technology should matter in the course. In some cases, the course instructor may have to help the teachers overcome doubts, biases, and fears created by negative technology experiences. The teachers’ principals must help them understand how these new technology skills will be directly useful in the classroom.

Emphasis should be on the teachers’ internal motivation to take the courses. School districts could improve teachers’ technology professional development experiences by honoring teachers as independent, ready learners who come to the classes with applicable experiences and are expecting practical, performance-based ideas.
CHAPTER 3

Methodology

The purpose of this survey study was to explore teachers' perceptions of technology professional development. This chapter describes the research design, sample, instrumentation, variables, and methods of data analysis that were used to conduct this study.

Design

The nature of this study was both descriptive and inferential. It used a random sample survey procedure to determine teachers' perceptions of technology professional development.

Sample

The random sample for the survey study was taken from two-thirds of the teachers in a suburban public school district in Nebraska, the teachers who took a technology flex course during the 2002-2003 school year. The other one-third of the district's teachers who were not eligible to participate took differentiated instruction training or did peer coaching. The random sample, at the district's request, included 443 teachers from the 605 teachers eligible, with a plan for 150 teachers to be selected from each of these levels: elementary, middle, and high school.

A random numbers chart was used to draw the random sample (Babbie, 2002). All eligible teachers who took tech flex during the 2002-2003 school year were numbered off into three groups: elementary, middle, and high school. Unequal numbers of eligible teachers from the three levels existed. Of the 250 elementary teachers who
took tech flex, 150 were randomly selected and asked to take the survey. Only 143 middle school teachers took tech flex, so all of them were asked to take the survey. Of the 212 high school teachers taking tech flex, 150 were randomly chosen to participate. The total random sample was 443 teachers out of the 605 who were eligible to participate. A total of 330 surveys out of 443 were completed for a return rate of 74%.

The teachers responded to the survey based on their technology flex course for the 2002-2003 school year. Because the survey ran from April 1 to the first week in May, the teachers who planned to take their technology course in June were excluded from the survey. The June course enrollment numbers were small because not many classes were offered in summer. There were no courses offered in May. Those teachers who applied for a waiver were included in the sample because they participated in an approved independent project that met their higher technology-related abilities. The following demographic data were collected for this study: gender, teacher age, grade level taught, years of teaching experience, subject taught, technology course delivery method, technology course content, and previous technology experience.

**Personal characteristics.** Of the participants who responded to the gender question, there were 70 (21.8%) male respondents and 251 (78.2%) female respondents. There were 28 teachers in the 21-25 years old age group (8.7%), 78 in the 26-35 age group (24.2%), 78 in the 36-45 age group (24.2%), 103 in the 46-55 age group (32.0%) and 35 in the 56 or older age group (10.9%).

**Professional characteristics.** The respondents were asked for the grade level of their 2002-2003 teaching assignment. Of the participants who responded, 8 taught
preschool (2.5%), 7 taught K-12 mixed (2.1%), 98 taught kindergarten through Grade 5 (30.1%), 112 taught Grades 6-8 (34.4%), and 101 taught Grades 9-12 (31.0%). The respondents were asked to indicate their years of teaching experience. Of the participants who responded, 41 were in the 1-3 years experience category (12.8%), 76 were in the 4-10 years category (23.8%), 41 were in the 11-15 years category (12.8%), 64 were in the 16-20 years category (20.0%), and 98 were in the more than 20 years of teaching experience category (30.6%).

The respondents were also asked the subject or subjects that they taught for the 2002-2003 school year. Seventy-five respondents taught elementary education (22.7%), 23 taught middle school mixed subjects (7.0%), 9 taught business (2.7%), 8 taught family and consumer science (2.4%), 17 taught foreign language (5.2%), 8 taught industrial tech (2.4%), 28 taught language arts (8.5%), 34 taught math (10.3%), 6 taught music (1.8%), 19 taught science (5.8%), 18 taught social studies (5.5%), 61 taught special education (18.5%), and 24 taught other, including art (7.3%). These teachers’ responses were recoded into five groups: elementary education (22.7%), middle school mixed subjects (7.0%), core subjects of language arts, math, science, and social studies (30.3%), special education (18.5%), and other subjects (21.5%). This last category included art, business, family and consumer science, industrial tech, music, and other.

The survey respondents were asked for the technology class delivery method that they experienced. Of the participants who responded, 247 had a traditional technology classroom experience (76.2%), 41 had an independent study experience (12.7%), and 36 had an online learning experience such as Element K (11.1%). The
respondents were asked about the technology course’s content. Of the participants who responded, 25 took a class in spreadsheet or databases such as Excel or Access (8%), 63 took word processing, publishing, or operating systems (20.1%), 79 took Internet, web design, or e-mail (25.2%), 43 took multimedia, such as PowerPoint or i-movie (13.7%), and 104 took classes that fell into the other category (33.1%). These included instruction in handhelds, building or curricular specialty classes, voice recognition software, an electronic grade book pilot, routers, and an introductory combination course for new teachers.

Teacher-respondents were also asked about their past technology experience. Of the participants who responded, 15 indicated that they had little technology experience (4.6%), 55 responded that they had a small amount of experience (16.7%), 178 responded that they had a moderate amount of experience (54.1%), 65 responded that they had a large amount of experience (19.8), and 16 responded that they had an extensive amount of experience (4.9%).

Data Collection

The data were collected through an online survey. The e-mail request for the participants to take the survey came from this researcher and the Office of Staff Development through the district’s e-mail. It contained a live link, which took the participants to the online survey site. The online survey site contained the cover letter and the online survey (see Appendix A). Appendix B contains the IRB letter approving the study. Participants could request a paper copy of the survey, which was sent through the internal district mail. The e-mail inviting the random sample to take the
survey was sent out in three tiers, by grade level, over 3 consecutive days so as not to overload the district’s e-mail servers. The district created a special e-mail address for this study called techstaffdeveval. The researcher created three e-mail user groups of elementary, middle, and high school teachers randomly selected to take the tech flex survey. A reminder e-mail was sent to any non-participant by mid-April, with 2 weeks left in the month to complete the survey. As the respondents took the survey, their e-mail addresses went into a separate database from their survey responses. That database was used to eliminate teachers who had completed the survey from the user groups before the reminder was sent. The 330 surveys were collected from April 1 to April 30, 2003. The return rate was 74%.

Instrumentation

Demographics. The following demographic variables were used in this study: gender, teacher age, grade level taught, years of teaching experience, subject taught, course delivery method, course content, and technology experience. The last two need explanation.

1. Course content delivery method asked if the course was taken online or in person in a classroom or lab. This was a choice in the technology flex program.

2. Course content meant the topic of the technology professional development. Some examples were word processing, Internet searches, or multimedia presentations. This was a choice in the technology flex program.
The survey instrument was centered on Knowles' assumptions about adult learners: need to know, self-concept, experience, readiness for learning, orientation for learning, and motivation for learning (Knowles et al., 1998).

Validity. A panel of experts, who gave input on the questions' appropriateness and clarity, examined a draft of the survey items to ensure content validity. A wide variety of professionals were included on the panel for feedback. Survey feedback was received from these school district people: the associate superintendents for both technology and educational services, the directors for both elementary and secondary education, the director for staff development, two curriculum facilitators, the information specialists' department chairperson, three instructional technology specialists, the technology staff development specialist, a research associate from the district's planning and evaluation department, an elementary principal, a middle school principal, and a high school principal. From the local university, three technology specialists from the College of Education and one professor from Educational Administration, who used to be the professional development director for a large neighboring metropolitan district, all gave feedback on the survey draft. Each member of the panel of experts was given some background information on Knowles' assumptions about adult learners. They were asked to review the survey for appropriateness and clarity, both for teacher technology professional development and the questions' relationship to Knowles' assumptions. Modifications were made to the draft survey based on their recommendations.
Pilot study. A pilot study to test the survey instrument was conducted in March of 2003 by sending a draft of the instrument to 33 teachers in the district who had already completed their technology flex course during the 2002-2003 school year. Twenty-five surveys were returned in a two-week period, providing a 76% return rate. Modifications were made to the final survey based on the pilot study results.

Reliability. For this survey study, the reliability coefficients of the subscales were computed using Cronbach's alpha on the data for the pilot and again for the final survey. Modifications to the final survey were made based on the findings from the pilot subscale analyses. Cronbach's alpha is an estimate of a test's reliability that measures internal consistency for questions within subscales and is used for Likert-scale surveys. The alpha range is between .0 and 1.0. Mitchell and Jolley (2003) consider a scale with an alpha of .70 or above to be internally consistent. When Cronbach's alpha was computed for each of the six subscales of the final survey, the results were as follows: need to know subscale (NK)(.7106), self-concept subscale (SC)(.8707), experience subscale (E)(.7042), readiness to learn subscale (RL)(.8100), orientation for learning subscale (OL)(.7812), and motivation for learning subscale (ML)(.7963).

Variables

The variables in this study included eight independent and six dependent variables. Descriptions of each follow.

Independent variables. The independent variables for this study were defined as follows:

1. gender (male or female)
2. teacher’s age (21-25, 26-35, 36-45, 46-55, 56 or older)

3. grade level taught (pre-school, K-5, 6-8, 9-12, K-12 mixed)

4. number of years of teaching experience (1-3 years, 4-10 years, 11-15 years, 16-20 years, and more than 20 years)

5. subject area taught (elementary education, middle school mixed subjects, core subjects, special education, and other)

6. course delivery method (traditional class, online, or independent study)

7. course type (spreadsheet/database, word processing/publishing/OS, Internet/e-mail/web design, multimedia, and other)

8. previous technology experience (little experience, small amount of experience, moderate amount of experience, large amount of experience, and extensive amount of experience)

Dependent variables. The dependent variables of teachers’ perceptions of technology professional development were defined as the mean scores on the six subscales: need to know, self-concept, experience, readiness for learning, orientation for learning, and motivation for learning.

Research Questions

The following research questions were drawn from the literature and were used to guide the study:

1. What are teachers’ perceptions of technology professional development? (Perceptions)

2. Does gender affect teachers’ perceptions of technology professional development? (Gender)
3. Does age affect teachers' perceptions of technology professional development? (Age)

4. Does grade level taught affect teachers' perceptions of technology professional development? (Grade level)

5. Does the number of years of experience affect teachers' perceptions of technology professional development? (Years of experience)

6. Does subject area taught affect teachers' perceptions of technology professional development? (Subject area taught)

7. Does the type of delivery method (traditional, independent, or online) affect teachers' perceptions of technology professional development? (Delivery method)

8. Does the course content affect teachers' perceptions of the technology professional development? (Class content)

9. Does experience with technology affect teachers' perceptions of technology professional development? (Technology experience)

Data Analysis

This study incorporated two methods of statistical analysis: the independent t-test and the one-way analysis of variance (ANOVA). The independent t-test was used to compare the difference between two groups (gender) on the dependent variables (teachers' perceptions of technology professional development). The one-way ANOVA was used to examine the differences among more than two groups, such as years of experience on the dependent variables. Because multiple statistical tests were conducted, a .01 level of significance was used to control for Type I errors.

Research question #1 was analyzed by using descriptive statistics, such as means and standard deviations.

Research question #2 was analyzed using an independent t-test in order to compare males and females.
Research questions #3, 4, 5, 6, 7, 8, and 9 were analyzed using one-way ANOVAs in order to compare these:

3) the five categories of teacher age,
4) the five categories of grade level taught,
5) the five categories of years of experience,
6) the five categories of subject taught,
7) the three categories of delivery method,
8) the five categories of course content, and
9) the five categories of technology experience.
Chapter 4

Results

The purpose of this survey study was to explore teachers' perceptions of technology professional development. An analysis of similar studies and related literature showed certain aspects of Knowles' adult learning theory could have an impact on teacher technology professional development (Fessler & Christensen, 1992; Fullen, 1991; Knowles et al., 1998; McDougall & Squires, 1997; Smerdon et al., 2000; Sparks & Hirsh, 2000; Wood & McQuarrie, 1999). Data were gathered by using an online survey sent out electronically to 443 randomly selected teachers in a suburban school district, with 330 responding for a 74% return rate. A 5-point Likert scale was used for the survey response. A score of 1 represented "strongly disagree" and a score of 5 represented "strongly agree". Only one item was negatively coded, as the other five negatively coded items were deleted during the survey pilot process. To make sure that this item would compare accurately with the others, statistical recoding was necessary. In addition, means were computed for each of the six survey subscales.

Research Question #1

What are teachers' perceptions of technology professional development?

Need to know. The overall mean score for the 12-item subscale for teachers' need to know was 3.89 (SD=0.49). Table 1 presents the means and the standard deviations of each survey item.

Self-concept. The overall mean score for the 9-item subscale for teachers' self-concept was 4.05 (SD=0.69). Table 2 presents the means and the standard deviations of
Table 1

**Teacher’s Perceptions of Technology Professional Development and Need to Know**

<table>
<thead>
<tr>
<th>Item</th>
<th>n</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>NK1. My tech flex class content was something that I needed to learn for my job.</td>
<td>327</td>
<td>3.77</td>
<td>1.06</td>
</tr>
<tr>
<td>NK2. The instructor or class introduction helped me understand the importance of learning about the class content.</td>
<td>325</td>
<td>4.05</td>
<td>0.88</td>
</tr>
<tr>
<td>NK3. I read articles about technology to gain insight or skills to supplement my learning.</td>
<td>327</td>
<td>2.77</td>
<td>1.19</td>
</tr>
<tr>
<td>NK4. I use technology to do my classroom assessments.</td>
<td>328</td>
<td>3.55</td>
<td>1.14</td>
</tr>
<tr>
<td>NK5. I use e-mail to communicate with other professionals inside my building.</td>
<td>327</td>
<td>4.79</td>
<td>0.59</td>
</tr>
<tr>
<td>NK6. I use e-mail to communicate with other professionals outside of my building.</td>
<td>328</td>
<td>4.57</td>
<td>0.76</td>
</tr>
<tr>
<td>NK7. I use e-mail to communicate with parents.</td>
<td>328</td>
<td>4.19</td>
<td>1.03</td>
</tr>
<tr>
<td>NK8. I know the process to locate tech resources in my building.</td>
<td>327</td>
<td>4.35</td>
<td>0.74</td>
</tr>
<tr>
<td>NK9. I know the process to locate tech resources in my district.</td>
<td>328</td>
<td>3.64</td>
<td>1.05</td>
</tr>
<tr>
<td>NK10. I use tech resources that help me provide differentiated instruction.</td>
<td>328</td>
<td>3.86</td>
<td>0.86</td>
</tr>
<tr>
<td>NK11. I use tech resources for student drill and practice.</td>
<td>328</td>
<td>3.40</td>
<td>1.15</td>
</tr>
<tr>
<td>NK12. I have my students use the Internet as a research tool.</td>
<td>328</td>
<td>3.64</td>
<td>1.21</td>
</tr>
</tbody>
</table>

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Table 2

Teacher’s Perceptions of Technology Professional Development and Self-Concept

<table>
<thead>
<tr>
<th>Item</th>
<th>n</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC1. I had a choice about my product or project in my tech flex class.</td>
<td>327</td>
<td>3.96</td>
<td>1.13</td>
</tr>
<tr>
<td>SC2. I felt I was in charge of my learning in my tech flex class.</td>
<td>327</td>
<td>4.13</td>
<td>0.96</td>
</tr>
<tr>
<td>SC3. I had some input on the class content once I started my tech flex class.</td>
<td>326</td>
<td>3.62</td>
<td>1.13</td>
</tr>
<tr>
<td>SC4. I received positive reinforcement as I learned.</td>
<td>327</td>
<td>4.19</td>
<td>0.92</td>
</tr>
<tr>
<td>SC5. I had the opportunity to practice what I learned.</td>
<td>327</td>
<td>4.34</td>
<td>0.83</td>
</tr>
<tr>
<td>SC6. The lessons in the class were well prepared.</td>
<td>325</td>
<td>4.30</td>
<td>0.89</td>
</tr>
<tr>
<td>SC7. I experienced the curriculum that I expected.</td>
<td>327</td>
<td>4.12</td>
<td>1.01</td>
</tr>
<tr>
<td>SC8. I had accommodations for my special needs.</td>
<td>325</td>
<td>3.53</td>
<td>0.98</td>
</tr>
<tr>
<td>SC9. I was encouraged to ask questions.</td>
<td>324</td>
<td>4.27</td>
<td>0.94</td>
</tr>
</tbody>
</table>

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each survey item.

Experience. The overall mean score for the 3-item subscale for teachers' experience was 3.80 (SD=0.86). Table 3 presents the means and the standard deviations of each survey item.

Readiness for learning. The overall mean score for the 6-item subscale for teachers’ readiness for learning was 4.08 (SD=0.74). Table 4 presents the means and the standard deviations of each survey item.

Orientation for learning. The overall mean score for the 6-item subscale for teachers’ orientation for learning was 3.74 (SD=0.67). Table 5 presents the means and the standard deviations of each survey item.

Motivation for learning. The overall mean score for the 8-item subscale for teachers’ motivation for learning was 3.73 (SD=0.62). Table 6 presents the means and the standard deviations of each survey item.

Research Question #2

Does gender affect teachers’ perceptions of technology professional development?

Need to know. There was no statistically significant difference between the mean scores of male (M=3.93, SD=0.56) and female (M=3.87, SD=0.46) teacher respondents on the need to know subscale (t(317)=0.915, p=.361).

Self-concept. There was no statistically significant difference between the mean scores of male (M=4.08, SD=0.87) and female (M=4.05, SD=0.61) teacher respondents on the self-concept subscale (t(316)=0.301, p=.764).
Table 3

**Teacher’s Perceptions of Technology Professional Development and Experience**

<table>
<thead>
<tr>
<th>Item</th>
<th>n</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1. My tech flex class added to my technology knowledge and skill-base</td>
<td>327</td>
<td>4.20</td>
<td>0.96</td>
</tr>
<tr>
<td>E2. A part of my class was sharing my previous technology experiences</td>
<td>326</td>
<td>3.28</td>
<td>1.11</td>
</tr>
<tr>
<td>E3. The degree of difficulty in my tech flex class was right for me, based on my experience</td>
<td>326</td>
<td>3.92</td>
<td>1.17</td>
</tr>
</tbody>
</table>

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Table 4

Teacher’s Perceptions of Technology Professional Development and Readiness for Learning

<table>
<thead>
<tr>
<th>Item</th>
<th>n</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>RL1. I have the software to use what I learned in my class.</td>
<td>325</td>
<td>4.02</td>
<td>1.15</td>
</tr>
<tr>
<td>RL2. I have people in my building to help me implement what I learned.</td>
<td>326</td>
<td>4.12</td>
<td>0.97</td>
</tr>
<tr>
<td>RL3. My building has the hardware (computer availability, memory, speed) to use what I learned.</td>
<td>325</td>
<td>4.09</td>
<td>1.09</td>
</tr>
<tr>
<td>RL4. The class choices were timely for me when I enrolled.</td>
<td>325</td>
<td>4.08</td>
<td>1.05</td>
</tr>
<tr>
<td>RL5. The times that classes were offered were convenient for me.</td>
<td>325</td>
<td>4.09</td>
<td>1.03</td>
</tr>
<tr>
<td>RL6. An eight-hour class gave me enough time to learn a new skill.</td>
<td>323</td>
<td>4.08</td>
<td>0.90</td>
</tr>
</tbody>
</table>
Table 5

Teacher's Perceptions of Technology Professional Development and Orientation for Learning

<table>
<thead>
<tr>
<th>Item</th>
<th>n</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>OL1. The instructor or online class explained how technology could help me create a product.</td>
<td>321</td>
<td>4.24</td>
<td>0.83</td>
</tr>
<tr>
<td>OL2. The instructor or online class explained how technology could help me solve problems.</td>
<td>323</td>
<td>4.02</td>
<td>0.89</td>
</tr>
<tr>
<td>OL3. What I learned in my tech flex class has nothing to do with my life or job.</td>
<td>324</td>
<td>1.81</td>
<td>0.96</td>
</tr>
<tr>
<td>OL3. Recoded</td>
<td>324</td>
<td>4.19</td>
<td>0.96</td>
</tr>
<tr>
<td>OL4. I changed my instruction due to what I learned.</td>
<td>324</td>
<td>2.88</td>
<td>1.06</td>
</tr>
<tr>
<td>OL5. I plan to use the new technology skills from class in the future.</td>
<td>324</td>
<td>3.99</td>
<td>0.93</td>
</tr>
<tr>
<td>OL6. What I learned in class helped me improve my students' achievement.</td>
<td>324</td>
<td>3.12</td>
<td>1.11</td>
</tr>
<tr>
<td>Item</td>
<td>n</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>----</td>
<td>------</td>
<td>-----</td>
</tr>
<tr>
<td>ML1. I took this tech flex class because I needed to know more about the topic.</td>
<td>319</td>
<td>3.91</td>
<td>1.14</td>
</tr>
<tr>
<td>ML2. My principal expects me to use technology in my classroom instruction.</td>
<td>319</td>
<td>3.93</td>
<td>0.84</td>
</tr>
<tr>
<td>ML3. My principal expects me to use technology for student assessment.</td>
<td>320</td>
<td>3.48</td>
<td>0.94</td>
</tr>
<tr>
<td>ML4. My principal expects me to use e-mail to communicate with colleagues.</td>
<td>319</td>
<td>4.48</td>
<td>0.71</td>
</tr>
<tr>
<td>ML5. My principal expects me to use e-mail to communicate with parents who have e-mail.</td>
<td>320</td>
<td>4.10</td>
<td>0.93</td>
</tr>
<tr>
<td>ML6. My principal expects my students to use technology in my classes.</td>
<td>318</td>
<td>3.95</td>
<td>0.89</td>
</tr>
<tr>
<td>ML7. I have building incentives to use technology in my classroom.</td>
<td>319</td>
<td>3.02</td>
<td>1.13</td>
</tr>
<tr>
<td>ML8. I have district incentives to use technology in my classroom.</td>
<td>319</td>
<td>2.97</td>
<td>1.10</td>
</tr>
</tbody>
</table>
Experience. There was no statistically significant difference between the mean scores of male ($M=3.87$, $SD=0.98$) and female ($M=3.78$, $SD=0.83$) teacher respondents on the experience subscale ($t(316)=0.831$, $p=.407$).

Readiness for learning. There was no statistically significant difference between the mean scores of male ($M=3.97$, $SD=0.87$) and female ($M=4.13$, $SD=0.68$) teacher respondents on the readiness for learning subscale ($t(316)=-1.651$, $p=.100$).

Orientation for learning. There was no statistically significant difference between the mean scores of male ($M=3.87$, $SD=0.67$) and female ($M=3.71$, $SD=0.65$) teacher respondents on the orientation for learning subscale ($t(314)=1.749$, $p=.081$).

Motivation for learning. There was no statistically significant difference between the mean scores of male ($M=3.86$, $SD=0.67$) and female ($M=3.71$, $SD=0.59$) teacher respondents on the motivation for learning subscale ($t(310)=1.833$, $p=.068$).

Research Question #3

Does age affect teachers' perceptions of technology professional development?

Need to know. The mean scores on the need to know subscale did not differ significantly across the five categories of age ($F(4, 315)=0.422$, $p=.793$). Table 7 presents the means and standard deviations of the need to know subscale scores broken down by the age category of the respondent.

Self-concept. The mean scores on the self-concept subscale did not differ significantly across the five categories of age ($F(4, 314)=0.978$, $p=.420$). Table 7 presents the means and standard deviations of the self-concept subscale scores broken down by the age category of the respondent.
Table 7

Means and Standard Deviations for the Subscales Across Age Category

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Age group</th>
<th>n</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need to know</td>
<td>21-25 years old</td>
<td>28</td>
<td>3.90</td>
<td>0.55</td>
</tr>
<tr>
<td></td>
<td>26-35 years old</td>
<td>78</td>
<td>3.84</td>
<td>0.40</td>
</tr>
<tr>
<td></td>
<td>36-45 years old</td>
<td>77</td>
<td>3.86</td>
<td>0.56</td>
</tr>
<tr>
<td></td>
<td>46-55 years old</td>
<td>103</td>
<td>3.93</td>
<td>0.48</td>
</tr>
<tr>
<td></td>
<td>56 years or older</td>
<td>34</td>
<td>3.87</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>320</td>
<td>3.88</td>
<td>0.49</td>
</tr>
<tr>
<td>Self-concept</td>
<td>21-25 years old</td>
<td>28</td>
<td>3.92</td>
<td>0.78</td>
</tr>
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<td>56 years or older</td>
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<td>0.72</td>
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<td>3.54</td>
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</table>
Experience. The mean scores on the experience subscale did not differ significantly across the five categories of age (F(4, 314)=2.383, p=.051). Table 7 presents the means and standard deviations of the experience subscale scores broken down by the age category of the respondent.

Readiness for learning. The mean scores of the readiness for learning subscale did not differ significantly across the five categories of age (F(4, 313)=1.013, p=.401). Table 7 presents the means and standard deviations of the readiness for learning subscale scores broken down by the age category of the respondent.

Orientation for learning. The mean scores of the orientation for learning subscale did not differ significantly across the five categories of age (F(4, 311)=1.738, p=.141). Table 7 presents the means and standard deviations of the orientation for learning subscale scores broken down by the age category of the respondent.

Motivation for learning. The mean scores of the motivation for learning subscale did not differ significantly across the five categories of age (F(4, 307)=2.367, p=.053). Table 7 presents the means and standard deviations of the motivation for learning subscale scores broken down by the age category of the respondent.

Research Question #4

Does grade level taught affect teachers’ perceptions of technology professional development?

Need to know. The mean scores of the need to know subscale did not differ significantly across the five categories of grade level taught (F(4, 319)=2.465, p=.045). Table 8 presents the means and standard deviations of the need to know subscale.
Table 8

Means and Standard Deviations for the Subscales Across Category of Grade Level Taught

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<th>Subscale</th>
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<th>M</th>
<th>SD</th>
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<td>3.60</td>
<td>0.41</td>
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<td>K-Grade 5</td>
<td>98</td>
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<td>0.48</td>
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<td></td>
<td>Grades 6-8</td>
<td>111</td>
<td>3.83</td>
<td>0.49</td>
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<tr>
<td></td>
<td>Grades 9-12</td>
<td>100</td>
<td>3.98</td>
<td>0.49</td>
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<td>Preschool</td>
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<td>0.64</td>
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<td>3.75</td>
<td>0.43</td>
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<td>Grades 6-8</td>
<td>110</td>
<td>3.86</td>
<td>0.75</td>
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<td></td>
<td>Grades 9-12</td>
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<td>0.69</td>
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<tr>
<td></td>
<td>Grades 6-8</td>
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<td>Grades 9-12</td>
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<td>Grades 9-12</td>
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<td>4.05</td>
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<td>0.65</td>
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<td>Grades 9-12</td>
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<td>0.69</td>
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<td></td>
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<td>321</td>
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<td>0.67</td>
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<td>Motivation for learning</td>
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<td>3.42</td>
<td>0.86</td>
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<tr>
<td></td>
<td>K-Grade 5</td>
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<td></td>
<td>Grades 6-8</td>
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<td>3.72</td>
<td>0.62</td>
</tr>
<tr>
<td></td>
<td>Grades 9-12</td>
<td>99</td>
<td>3.86</td>
<td>0.61</td>
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<td></td>
<td>Total</td>
<td>318</td>
<td>3.73</td>
<td>0.62</td>
</tr>
</tbody>
</table>

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scores broken down by the category of grade level taught.

**Self-concept.** The mean scores of the self-concept subscale differed significantly across the five categories of grade level taught ($F(4, 318)=4.023, p=.003$). Follow-up Tukey pairwise comparison tests indicated that the mean score of the self-concept subscale differed significantly for teachers who taught Grades 6-8 from those who taught Grades 9-12 ($p=.003$). Table 8 presents the means and standard deviations for the self-concept subscale scores broken down by the category of grade level taught.

**Experience.** The mean scores of the experience subscale did not differ significantly across the five categories of grade level taught ($F(4, 318)=1.133, p=.341$). Table 8 presents the means and standard deviations of the experience subscale scores broken down by the category of grade level taught.

**Readiness for learning.** The mean scores of the readiness for learning subscale did not differ significantly across the five categories of grade level taught ($F(4, 318)=0.707, p=.587$). Table 8 presents the means and standard deviations of the readiness for learning subscale scores broken down by the category of grade level taught.

**Orientation for learning.** The mean scores of the orientation for learning subscale did not differ significantly across the five categories of grade level taught ($F(4, 316)=1.964, p=.100$). Table 8 presents the means and standard deviations of the orientation for learning subscale scores broken down by the category of grade level taught.
Motivation for learning. The mean scores of the motivation for learning subscale did not differ significantly across the five categories of grade level taught ($F(4, 313)=2.240, p=.065$). Table 8 presents the means and standard deviations of the motivation for learning subscale scores broken down by the category of grade level taught.

Research Question #5

Does the number of years of experience affect teachers’ perceptions of technology professional development?

Need to know. The mean scores of the need to know subscale did not differ significantly across the five categories of years of experience ($F(4, 313)=1.675, p=.156$). Table 9 presents the means and standard deviations of the need to know subscale scores broken down by the category of years of experience.

Self-concept. The mean scores of the self-concept subscale did not differ significantly across the five categories of years of experience ($F(4, 312)=1.979, p=.098$). Table 9 presents the means and standard deviations of the self-concept subscale scores broken down by the category of years of experience.

Experience. The mean scores of the experience subscale did not differ significantly across the five categories of years of experience ($F(4, 312)=2.571, p=.038$). Table 9 presents the means and standard deviations of the experience subscale scores broken down by the category of years of experience.

Readiness for learning. The mean scores of the readiness for learning subscale did not differ significantly across the five categories of years of experience
Table 9

Means and Standard Deviations for the Subscales Across Category of Years of Experience

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<thead>
<tr>
<th>Subscale</th>
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<th>M</th>
<th>SD</th>
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</thead>
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<td>3.83</td>
<td>0.38</td>
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<td>4-10 years</td>
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<td>3.86</td>
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<td>16-20 years</td>
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<td>3.79</td>
<td>0.50</td>
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<tr>
<td></td>
<td>21 and more</td>
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<td>3.93</td>
<td>0.49</td>
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<td>11-15 years</td>
<td>93</td>
<td>4.19</td>
<td>0.65</td>
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<td>16-20 years</td>
<td>63</td>
<td>4.07</td>
<td>0.61</td>
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<tr>
<td></td>
<td>21 and more</td>
<td>98</td>
<td>4.15</td>
<td>0.67</td>
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<td>Total</td>
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<td>1.03</td>
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<td>0.91</td>
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<td></td>
<td>11-15 years</td>
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<td></td>
<td>21 and more</td>
<td>98</td>
<td>3.91</td>
<td>0.75</td>
</tr>
<tr>
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<td>0.79</td>
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<td>4.04</td>
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<td>21 and more</td>
<td>98</td>
<td>4.12</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>Total</td>
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<td>4.09</td>
<td>0.73</td>
</tr>
<tr>
<td><strong>Orientation</strong></td>
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<tr>
<td>for learning</td>
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<td>75</td>
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<tr>
<td></td>
<td>21 and more</td>
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<td>3.81</td>
<td>0.65</td>
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<tr>
<td></td>
<td>Total</td>
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<td>3.75</td>
<td>0.67</td>
</tr>
<tr>
<td><strong>Motivation</strong></td>
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<td>41</td>
<td>3.55</td>
<td>0.51</td>
</tr>
<tr>
<td>for learning</td>
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<tr>
<td></td>
<td>21 and more</td>
<td>95</td>
<td>3.90</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>311</td>
<td>3.74</td>
<td>0.62</td>
</tr>
</tbody>
</table>
Table 9 presents the means and standard deviations of the readiness for learning subscale scores broken down by the category of years of experience.

**Orientation for learning.** The mean scores of the orientation for learning subscale did not differ significantly across the five categories of years of experience \(F(4, 310) = 0.863, p = .486\). Table 9 presents the means and standard deviations of the orientation for learning subscale scores broken down by the category of years of experience.

**Motivation for learning.** The mean scores of the motivation for learning subscale differed significantly across the five categories of years of experience \(F(4, 306) = 4.474, p = .002\). Follow-up Tukey pairwise comparison tests indicated that the mean scores of the motivation for learning subscale did not differ significantly at the .01 alpha level. Table 9 presents the means and standard deviations of the motivation for learning subscale scores broken down by the category of years of experience.

**Research Question #6**

Does subject area taught affect teachers’ perceptions of technology professional development?

**Need to know.** The mean scores of the need to know subscale did not differ significantly across the five categories of subject area taught \(F(4, 323) = 0.477, p = .752\). Table 10 presents the means and standard deviations of the need to know subscale scores broken down by the category of subject area taught.
<table>
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<tr>
<th>Subscale</th>
<th>Subject taught</th>
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<td>Middle school</td>
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<td>3.57</td>
<td>0.73</td>
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<td></td>
<td>Core subjects</td>
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<td>3.74</td>
<td>0.69</td>
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<tr>
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<td>Special ed</td>
<td>61</td>
<td>3.80</td>
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<td>Other</td>
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<td>Total</td>
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<td>0.62</td>
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</table>
Self-concept. The mean scores of the self-concept subscale did not differ significantly across the five categories of subject area taught ($F(4, 322)=1.604, p=.173$). Table 10 presents the means and standard deviations of the self-concept subscale scores broken down by the category of subject area taught.

Experience. The mean scores of the experience subscale did not differ significantly across the five categories of subject area taught ($F(4,322)=0.578, p=.679$). Table 10 presents the means and standard deviations of the experience subscale scores broken down by the category of subject area taught.

Readiness for learning. The mean scores of the readiness for learning subscale did not differ significantly across the five categories of subject area taught ($F(4,321)=3.041, p=.018$). Table 10 presents the means and standard deviations of the readiness for learning subscale scores broken down by the category of subject area taught.

Orientation for learning. The mean scores of the orientation for learning subscale did not differ significantly across the five categories of subject area taught ($F(4,319)=1.120, p=.347$). Table 10 presents the means and standard deviations of the orientation for learning subscale scores broken down by the category of subject area taught.

Motivation for learning. The mean scores of the motivation for learning subscale did not differ significantly across the five categories of subject area taught ($F(4,315)=0.174, p=.952$). Table 10 presents the means and standard deviations of the
motivation for learning subscale scores broken down by the category of subject area taught.

Research Question #7

Does the type of delivery method (traditional, independent, online) affect teachers' perceptions of technology professional development?

Need to know. The mean scores of the need to know subscale did not differ significantly across the three categories of delivery method ($F(2, 319)=0.601, p=.549$). Table 11 presents the means and standard deviations of the need to know subscale scores broken down by the category of technology course delivery method.

Self-concept. The mean scores of the self-concept subscale did not differ significantly across the three categories of delivery method ($F(2, 318)=4.596, p=.011$). Table 11 presents the means and standard deviations of the self-concept subscale scores broken down by the category of technology course delivery method.

Experience. The mean scores of the experience subscale did not differ significantly across the three categories of delivery method ($F(2, 318)=2.236, p=.109$). Table 11 presents the means and standard deviations of the experience subscale scores broken down by the category of technology course delivery method.

Readiness for learning. The mean scores of the readiness for learning subscale did not differ significantly across the three categories of delivery method ($F(2, 318)=0.901, p=.407$). Table 11 presents the means and standard deviations of the readiness for learning subscale scores broken down by the category of technology course delivery method.
Table 11

Means and Standard Deviations for the Subscales Across Category of Course Delivery

<table>
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<tr>
<th>Subscale</th>
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<th>n</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
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<td></td>
<td>Independent</td>
<td>41</td>
<td>3.96</td>
<td>0.48</td>
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<tr>
<td></td>
<td>Online</td>
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<td>3.86</td>
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<td>0.49</td>
</tr>
<tr>
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<td>4.08</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>Independent</td>
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<td>4.15</td>
<td>0.63</td>
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<tr>
<td></td>
<td>Online</td>
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<td>3.73</td>
<td>0.62</td>
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<td>Total</td>
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<td>4.05</td>
<td>0.69</td>
</tr>
<tr>
<td>Experience</td>
<td>Traditional</td>
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<td>3.75</td>
<td>0.90</td>
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<tr>
<td></td>
<td>Independent</td>
<td>41</td>
<td>4.06</td>
<td>0.67</td>
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<tr>
<td></td>
<td>Online</td>
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<td>321</td>
<td>3.79</td>
<td>0.86</td>
</tr>
<tr>
<td>Readiness for learning</td>
<td>Traditional</td>
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<tr>
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<td></td>
<td>Online</td>
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<td>315</td>
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</table>
Orientation for learning. The mean scores of the orientation for learning subscale did not differ significantly across the three categories of delivery method ($F(2, 316)=0.266, p=.766$). Table 11 presents the means and standard deviations of the orientation for learning subscale scores broken down by the category of technology course delivery method.

Motivation for learning. The mean scores of the motivation for learning subscale did not differ significantly across the three categories of delivery method ($F(2, 312)=4.415, p=.013$). Table 11 presents the means and standard deviations of the motivation for learning subscale scores broken down by the category of technology course delivery method.

Research Question #8

Does the course content affect teachers' perceptions of the technology professional development?

Need to know. The mean scores of the need to know subscale did not differ significantly across the five categories of course content ($F(4, 308)=1.149, p=.333$). Table 12 presents the means and standard deviations of the need to know subscale scores broken down by the category of technology course content.

Self-concept. The mean scores of the self-concept subscale did not differ significantly across the five categories of course content ($F(4, 307)=2.408, p=.049$). Table 12 presents the means and standard deviations of the self-concept subscale scores broken down by the category of technology course content.
Table 12

Means and Standard Deviations for the Subscales Across Category of Course Content

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<th>Subscale</th>
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<td></td>
<td>Word/pub/OS</td>
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<td>Internet/web/mail</td>
<td>78</td>
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<td>Multimedia</td>
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</table>

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
Experience. The mean scores of the experience subscale did not differ significantly across the five categories of course content ($F(4, 307)=1.581$, $p=.179$). Table 12 presents the means and standard deviations of the experience subscale scores broken down by the category of technology course content.

Readiness for learning. The mean scores of the readiness for learning subscale did not differ significantly across the five categories of course content ($F(4, 306)=0.649$, $p=.628$). Table 12 presents the means and standard deviations of the readiness for learning subscale scores broken down by the category of technology course content.

Orientation for learning. The mean scores of the orientation for learning subscale did not differ significantly across the five categories of course content ($F(4, 305)=1.025$, $p=.394$). Table 12 presents the means and standard deviations of the orientation for learning subscale scores broken down by the category of technology course content.

Motivation for learning. The mean scores of the motivation for learning subscale did not differ significantly across the five categories of course content ($F(4, 302)=0.062$, $p=.993$). Table 12 presents the means and standard deviations of the motivation for learning subscale scores broken down by the category of technology course content.

Research Question #9

Does experience with technology affect teachers' perceptions of technology professional development?
**Need to know.** The mean scores of the need to know subscale differed significantly across the five categories of technology experience ($F(4, 323)=6.855$, $p<.0005$). Follow-up Tukey pairwise comparison tests indicated that the mean scores of the need to know subscale differed significantly between the groups with a small amount of technology experience and a large amount of technology experience ($p<.0005$), between the groups with a small amount of technology experience and an extensive amount of technology experience ($p=.008$), and between the groups with a moderate amount of technology experience and a large amount of technology experience ($p=.004$). Table 13 presents the means and standard deviations of the need to know subscale scores broken down by the category of previous technology experience.

**Self-concept.** The mean scores of the self-concept subscale did not differ significantly across the five categories of technology experience ($F(4, 322)=1.311$, $p=.266$). Table 13 presents the means and standard deviations of the self-concept subscale scores broken down by the category of previous technology experience.

**Experience.** The mean scores of the experience subscale did not differ significantly across the five categories of technology experience ($F(4, 322)=0.467$, $p=.760$). Table 13 presents the means and standard deviations of the experience subscale scores broken down by the category of previous technology experience.

**Readiness for learning.** The mean scores of the readiness for learning subscale did not differ significantly across the five categories of technology experience ($F(4, 321)=1.600$, $p=.174$). Table 13 presents the means and standard deviations of the
Table 13

Means and Standard Deviations for the Subscales Across Category of Technology

<table>
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<th>Subscale</th>
<th>Experience</th>
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<th>M</th>
<th>SD</th>
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readiness for learning subscale scores broken down by the category of previous technology experience.

**Orientation for learning.** The mean scores of the orientation for learning subscale did not differ significantly across the five categories of technology experience ($F(4, 319)=0.584, p=.674$). Table 13 presents the means and standard deviations of the orientation for learning subscale scores broken down by the category of previous technology experience.

**Motivation for learning.** The mean scores of the motivation for learning subscale did not differ significantly across the five categories of technology experience ($F(4, 315)=1.312, p=.265$). Table 13 presents the means and standard deviations of the motivation for learning subscale scores broken down by the category of previous technology experience.
Chapter 5
Discussion and Implications

Introduction

The purpose of this survey study was to explore teachers’ perceptions of technology professional development. Data were gathered by using an online survey sent out electronically to 443 randomly selected teachers in a suburban school district, with 330 responding for a 74% return rate. The following independent variables were used in this study: gender, teacher age, grade level taught, years of teaching experience, subject taught, course delivery method, course content, and technology experience. The dependent variables of teachers’ perceptions of technology professional development were defined as the mean scores on the six subscales: need to know, self-concept, experience, readiness for learning, orientation for learning, and motivation for learning. Statistically significant results were found in the self-concept subscale scores between the middle and high school teachers. For the need to know subscale scores, statistically significant results were found between the small and large amount of technology experience groups, between the small and extensive amount of technology experience groups, and between the moderate and large amount of technology experience groups. This chapter will discuss the findings of this study and suggest further research on teacher technology professional development and teacher professional development.

Discussion

Gender. This study found no statistically significant evidence that the male or female teachers differed in their perceptions of the technology professional
development. Perhaps no statistically significant difference for gender was found in this study for this school district because there were three options for course type: traditional classroom, online, and independent study. Teachers could choose a course option that best suited their learning preferences.

**Age.** This study found no statistically significant evidence that the teachers of various age groups differed in their perceptions of technology professional development.

**Grade level.** This study found statistically significant evidence that the self-concept subscale scores differed across the five categories of grade level taught. Follow-up Tukey pairwise comparison tests indicated that the self-concept subscale perception scores differed significantly for teachers who taught Grades 6-8 from those who taught Grades 9-12, with teachers in Grades 9-12 having the higher mean score. The questions in the subscale had to do with the adult learners feeling responsible and in charge of their own learning. Part of this finding was unexpected, as the researcher expected the significant differences to have been between the teachers of younger students (preschool or K-5) and the high school teachers. In the literature, the variable of grade level taught was used in a study about teachers' use of technology and their perceived barriers for technology use, not whether a technology course met their adult needs as this study did. One NCES report found that elementary teachers were more likely to communicate with parents using technology and have students do projects in the classroom (Smerdon et al., 2000). The secondary teachers used the computers for record keeping, outside class projects, and student research on the Internet. The same
study analyzed the most frequently reported barriers to levels of computer use, and secondary teachers reported not enough computers, while elementary teachers were more likely to list lack of time as a barrier.

**Years of experience.** This study found no statistically significant evidence that teachers' perceptions of technology professional development differed across the five categories of teaching experience. The questions in the subscale had to do with intrinsic motivation to know more about the technology topic, principals' technology use expectations, and incentives to use technology, both at the building and district level. In the literature, the number of years of experience was a variable that seemed to affect technology use and course work (Smerdon et al., 2000). Teachers with 20 or more years of experience reported taking all types of computer training at higher rates than other teachers reported. The widest separation came from computer basics course work, with 90% of 20+ years of experience teachers taking that type of training. Conflicting information was reported in an Ohio math software study, which found that teachers with 20+ years used the software at the same rate as newer teachers (Deubel, 2001). The NCES study on teacher technology use showed that teachers with more years of experience more often listed lack of release time to learn as a barrier as opposed to teachers with less experience (Smerdon et al., 2000). This made sense because the younger teachers may have a greater comfort level with technology. However, teacher age and years of experience do not always correlate well, especially in female teachers who have taken time off to raise families or in adults who have made teaching a second
career later in life. As the more experienced teacher becomes more comfortable with technology, the gap may close for years of experience and technology use.

**Subject taught.** This study found no statistically significant evidence that the teachers who taught various subjects differed in their perceptions of technology professional development. This finding was unexpected because not all curricular areas have embraced technology in the same way and in the same time frame. The category of special education scored highest in the subscale of readiness for learning. Many of the district’s special education teachers took a specialized course for use of the district’s new online Individualized Learning Plans, something necessary for their jobs.

Subject taught was the study’s variable that was most influenced by the district’s professional development cycle. It impacted which teachers enrolled for tech flex during the 2002-2003 school year. The district started a new 3-year professional development cycle, with teachers spending 2 out of the 3 years taking tech flex. The alternate year’s training was called Differentiation Instruction II or Diff II. Teachers were encouraged to sign up for Diff II in same-subject or same-grade-level teaching teams; for example, all middle school foreign language teachers or fifth grade teachers from a certain building. The other beginning district initiative of the 3-year new teacher induction program in 2002-2003 also influenced the increasing number of teachers who were peer coaching and not eligible for the tech flex sample.

**Delivery method.** This study found no statistically significant evidence that the type of technology course delivery method affected teachers’ perceptions of technology professional development. The subscale questions had to do with support but also
convenient times for the course and enough time to learn the new skill. While 11% of respondents chose the independent study course method in this study, they scored the highest on all the other subscales. This was expected, as the most advanced technology users often choose independent study. In the literature reviewed, studies said that many teachers' technology skills are self-taught through trial and error. For 58% of the respondents in the Ohio math software proficiency study, what they knew about computers and the math software had been learned on their own (Deubel, 2001). Teachers surveyed in the NCES teacher technology use survey said that independent learning was the method most frequently selected to ready teachers for technology use, with formal professional development courses coming in second (Smerdon et al., 2000). Half of them said college/graduate classes prepared them. A graduate class would have fallen under independent study for this study's purposes.

**Course content.** This study found no statistically significant evidence that the technology course content affected teachers to differ in their perceptions of technology professional development. In the literature reviewed, the NCES teacher technology-use survey asked about the types of courses teachers had taken: Internet use (75%), software applications (81%), basic computer training (83%), integration of technology into instruction (74%), follow-up or advanced training (55%), and use of other advanced telecommunications (53%). Half of the teachers said the follow-up classes and more advanced training were available after the initial course (Smerdon et al., 2000). Many of the courses offered by the district in this study were advanced training options.
Technology experience. This study found statistically significant evidence that the teachers' need to know subscale mean scores differed across the five categories of technology experience. Follow-up Tukey pairwise comparison tests indicated that the mean scores on the need to know subscale differed significantly between the groups with a small and large amount of technology experience, between the groups with a small and extensive amount of technology experience, and between the groups with a moderate and a large amount of technology experience. The questions in the need to know subscale had to do with adults understanding why they needed to learn something and to recognize gaps in their personal knowledge about a topic. A limitation of using this demographic data was that the range of technology experience was self-reported instead of being determined by set criteria or a benchmark test.

For the first two significant findings, the mean score for the respondents who self-reported a large and extensive amount of technology experience was higher than the mean score for the small amount of technology experience group. For the third significant finding, the mean score for the respondents who self-reported a large amount of technology experience was higher than the moderate amount of technology experience group. In the literature reviewed, a Milkin Family Foundation (1999) study reported that of the Nebraska school districts surveyed, over 50% responded being advanced on computer use, software, and the Internet. In this study, using a Nebraska suburban district, only 65 out of 328 (20%) respondents self-reported having a large amount of experience, while 16 out of 328 (5%) reported extensive technology experience. Another study in the literature showed that teachers assessed themselves as
intermediate users of technology, yet they reported not feeling prepared to use technology (Ivers, 2001). The researchers in the Ivers’ study concluded that a self-evaluation is only as accurate as one’s perception, and that merely using technology does not qualify teachers as intermediate users or mean that they integrate it into instruction effectively. Self-reporting technology experience is a very inexact process.

**Implications for Practice**

Specific questions from this study’s survey could be used by other school districts to determine the status of their teachers’ technology use and opinions about technology training. Also, the results from some of the survey questions could be important to practitioners inside the study’s suburban school district.

**Future technology professional development.** This study found no statistically significant findings in the data gathered on teachers’ perceptions of technology professional development based on gender, age, years of experience, subject taught, or course delivery method for the suburban school district. This could mean that the suburban school district’s future technology professional development does not need to be differentiated for these variables. However, because statistically significant findings were evident for grade level and previous technology experience, the district should consider differentiating future technology professional development based on these variables. In the experience subscale, Question 1 asked if the course added to their technology knowledge and skill base ($M=4.20$, $SD=0.96$), and Question 3 asked if the degree of difficulty was correct for teachers based on their experience ($M=3.92$, $SD=1.17$). Most course descriptions on the district’s professional development website...
tell whether the course is for beginners or advanced learners and list any suggested prerequisites to help teachers select an appropriate course.

In general, the teachers seemed satisfied with some aspects of the course offerings. In the readiness for learning subscale, Question 4 asked if the class topic choices were timely for the teacher; Question 5 asked if the course times were convenient, while Question 9 asked if an 8 hour class was enough time to learn a new skill. The range of mean scores for these questions was 4.08 to 4.09, which meant that the teachers were very satisfied. In the subscale orientation for learning, negatively worded Question 3 asked this, “What I learned in my tech flex class has nothing to do with my life or job.” The mean score was 1.81 (SD=0.96), while the recoded mean score was 4.19, signifying that many teachers found their courses to be valuable.

Instructor. The teachers’ perception data for the tech flex professional development showed that the instructor helped them understand the importance of learning about the course’s content. In the self-concept subscale, Question 1 asked about course product (M=3.96, SD=1.13), while Question 3 asked about teacher input on the course’s content once in the course (M=3.62, SD=1.13), a lower mean score. The other questions in the self-concept subscale rated the instructor of the teacher technology course. Question 2 asked if the teacher felt in charge of his or her own learning; Question 4 had to do with positive reinforcement from the instructor, while Question 5 asked if the teachers had an opportunity to practice what they had learned. Question 9 asked if the teachers were encouraged to ask questions. Question 6 asked whether the lessons were well prepared, and Question 7 asked if the course’s curriculum...
taught was the curriculum expected. The range of mean scores for the above questions in the self-concept subscale was 4.13 to 4.34. While there is always room to improve, the district should be pleased with those perception scores. Accommodations for any special needs was Question 8 with a lower mean score (\(M=3.53, \text{SD}=0.98\)), which could have meant accommodations for a physical disability or accommodations for a time conflict with the course.

In the experience subscale, Question 2 asked if sharing previous experience was a part of the course (\(M=3.28, \text{SD}=1.11\)), which was a relatively low score. In the orientation for learning subscale, Question 1 asked if the instructor explained how the technology could help the teacher create a project, and Question 2 asked if the instructor helped the teacher understand how technology could help solve problems. These questions had mean scores in a range from 4.02 to 4.24. These scores were not surprising since a technology course often helps one create a product, such as with PowerPoint, or solve a clerical issue, such as the organization a database can bring.

The quality of instruction for the adult learners of a school district is very important because what they learn often impacts how they teach. This survey study showed that teachers' perceptions of their tech flex experience could be improved with teaching techniques geared to the unique needs of adult learners. The people teaching these courses were district employees who were trained to teach children. Until 5 years ago, the district required that anyone who taught a professional development course had to take a course called "Training the Trainer" to prepare them to teach adults. A
possible recommendation is that the course becomes mandatory again as a requirement for anyone who teaches a district professional development course.

Locating resources. Questions 8 and 9 from the need to know subscale asked teachers if they knew how to locate building and district technology resources. Teachers in this study scored higher on locating resources in their own buildings (M=4.35, SD=0.74) than they did knowing how to locate district resources (M=3.64, SD=1.05). This may be due to the district’s protocol for accessing technology resources. Each building has a technology initiator, who is the contact for district technology troubleshooting help instead of the teacher. In addition, funds for new technology flow through the building principal or through the curriculum office, not by individual teacher request to the district’s central office.

Questions 7 (M=3.02, SD=1.13) and Question 8 (M=2.97, SD=1.10) from the motivation for learning subscale asked teachers to rate their knowledge about building and district technology-use incentives. These are relatively low perception scores for a 5-point Likert scale. Improvements could be made in both of these areas through better communication about available resources. District teachers can write funding grants for additional software and materials and submit them once a year to the district’s educational foundation for consideration. Some buildings also write state-funded grants for additional technology.

Questions 1 through 3 from the readiness for learning subscale dealt with technology support at the individual school, such as hardware, software, and personnel support. Question 1 related to software; Question 2 related to personnel, while
Question 3 related to hardware, all with a range of mean scores from 4.02 to 4.12. While there is always room to improve, the district should be pleased with these results. The district could use the study’s data and determine by individual school codes which buildings need improvement in any of the three areas. In the literature, one reason that teachers gave for not using computers was the lack of technical support. The ISTE index for districts suggests that exemplary technology support should mean less than a 75:1 ratio of computers to technician (ISTE, 2001).

Principal’s expectations. Questions 2 through 6 in the motivation for learning subscale dealt with the building principal’s expectations for teacher technology use. The district could use the study’s data and sort by school code to obtain very specific information about each building and the principal’s teacher-perceived expectations for teacher technology use. However, many of the suburban school district’s buildings were not represented as well as others in this study due to the random sample and the teachers’ choices of tech flex or differentiation for the 2002-2003 school year.

Question 2 asked if the principal expects the teacher to use technology in instruction (M=3.93, SD=0.84). The district completed a writing project that infused technology-use expectations in the teacher evaluation materials, which was shared with all teachers in the fall of 2003. Technology is still considered a teaching tool and should be used to help students achieve their course outcomes. In the need to know subscale, Question 10 asked if the teacher used technology sources to differentiate instruction; Question 11 asked if the teacher used technology for skill and drill, while Question 12 asked about students using the Internet as a research tool. The range of
means scores was 3.40 to 3.86, indicating all three of these areas could use improvement. Since differentiated instruction is the district’s other major professional development thrust, this is one key area where the district could improve by helping teachers see how to use technology to differentiate instruction.

Question 3 asked if the principal expects the teacher to use technology for student assessment ($M=3.48$, $SD=0.94$). In another subscale, readiness for learning, the teachers’ perceptions for Question 1 on software, Question 2 on personnel, and Question 3 on hardware had a more favorable mean score range of 4.02 to 4.12, indicating that availability and support are not the reason why technology is not used more for assessment. The district may need to provide further technology professional development to help teachers learn how to use technology for assessment.

Questions 4 and 5 asked if the principal expects the teacher to use e-mail to communicate with colleagues ($M=4.48$, $SD=0.7$) and with parents who have e-mail ($M=4.10$, $SD=0.93$). These scores are very favorable and indicate strong use of e-mail. School buildings could save money on paper if all staff members read their e-mail daily because fewer paper memos would be needed. Question 6 asked if the principal expects the students in the class to use technology ($M=3.95$, $SD=0.89$). This mean score should have been much higher. The district has emphasized technology by having an associate superintendent for technology, a technology division, and passing several technology-related bond issues. Teacher expectation of student technology use would be a key piece of data from this study that the school district could analyze by school code. In the literature, lack of administrative support was listed as a barrier for 55% of the
respondents without a technology coordinator (Smerdon et al., 2000). In the Ohio proficiency math test study, 97% of the teachers who actually used the software reported higher administrative support (Deubel, 2001). The principal sets the tone for technology use and instructional excellence.

**Impact on teaching.** Question 6 in the orientation for learning subscale asked about changes in teaching and student achievement as a result of the technology professional development ($M=3.12$, $SD=1.11$), a lower score than might be expected and very disappointing. Question 1 in the need to know subscale asked if the tech flex course content was something that the teacher needed to know for the job, while Question 5 asked if the teacher planned to use their new technology skills from the class. These questions had a mean score range from 3.77 to 3.99, which is more encouraging. Question 4 asked if the teacher changed his or her instruction due to what was learned in the course. Question 4 had a much lower mean score of 2.88. This could be because some teachers took classes in instructional software or Internet searching, while others took classes on e-mail or operating systems that might not impact instruction.

In the literature, The National Staff Development Council (NSDC) recommends that school districts do the following: hold superintendents and principals, as well as teachers, accountable for student achievement in their performance evaluations; invest at least 10% of the budget in teacher learning; make sure school improvement plans focus on student achievement; and embed opportunities for professional development into the teachers’ day. Also in the literature, the overall results of a meta-analysis of
700 studies showed that students who use technology made gains in achievement as measured in a variety of ways (Schacter, 1999).

However, Guskey (2003) criticized schools for not having student achievement results as the foremost indicator of professional development effectiveness. He evaluated 13 separate lists of effective professional development characteristics from organizations such as The American Federation of Teachers, The Association of Curriculum and Instruction, The Educational Research Service, The National Institute for Science Education, The Eisenhower Professional Development Program, and The U.S. Department of Education. Each group's list of effective professional development characteristics varied widely. The area of teacher professional development could use leadership to further research and reform what are considered best practices for effective professional development.

Implications for Research

**Mandatory or voluntary.** Many possibilities for further research exist. In the literature, few studies mentioned any differences in results between mandatory and voluntary technology professional development. In fact, many articles did not mention if the training was mandatory or voluntary, unless it was a pilot or grant study. A study by Scottish researchers found that teachers' lack of progress toward 46 established technology competencies had to do with the fact that the training was voluntary. They were afraid to make it mandatory because the "technophobics" might not do as in-depth a study (Van der Kuyl et al., 2001). This is one variable that needs further exploration.
Replication of the study. This teacher technology professional development survey study could be replicated and further evaluated to confirm its findings. The survey could be replicated the next year by the same suburban school district to see if teachers' responses were consistent. Because the variable subject taught was heavily impacted by the district's professional development 3-year cycle, this survey could be used to conduct a longitudinal study. A random sample of teachers taking tech flex during all 3 years of the cycle could take the survey so that each curricular area's input would be reflected in longitudinal 3-year results. In addition, instead of surveying the teachers, the survey's questions could be modified to include the district's guidance counselors, building administrators, and certificated central office employees who are also required to complete the district's 3-year professional development cycle.

It would be interesting to replicate the survey study in an urban or rural school district to compare the results to those from this study completed in a suburban school district. Also, the theoretical framework used for the study, Knowles' theory of adult learning, could be used as a framework when creating other adult survey instruments to evaluate different kinds of professional development, both inside and outside of the field of education. It would be an excellent theoretical framework for adult surveys used to evaluate college and university classes. In addition, some of the survey's questions could be placed in a different theoretical framework for analysis, such as teacher efficacy or multiple intelligences.

Impact on student achievement. A key focus for further research on teacher professional development should be its impact on student achievement. Guskey (2003)
says that it should be the “ultimate” goal but has been the focus only in science and mathematics. In the literature, teachers in one study received 72 hours of staff development training in technology and constructivists’ methods of instruction (Heath & Ravitz, 2001). Among the teachers participating in this study, 77% said these workshops influenced their teaching, and 78% said the computing opportunity and experience changed their teaching. Over half of them said the person who gives them the best ideas about teaching seems to know a lot about computers. These are the teachers who are lifelong learners, who emulate the love of learning that schools want to instill in their students, our future leaders.
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APPENDIX A

Survey Instrument and Letter to Participants
Dear Teacher,

You were selected as part of a random sample of teachers who took a technology flex course this 2002-03 school year. We are asking for your help in assessing the district's tech flex program by filling out a survey, either online or by requesting a paper copy. Mrs. Kaspar will be the principal investigator and researcher, but the research is being conducted for district purposes. The results of the survey will be used to provide continued excellence in our staff development program.

The survey asks for your name and other demographic information. Be assured this information will all be kept confidential. The names will be kept in a separate database from the survey responses. The reason that we are asking for your name is to track which people have completed the survey. This allows us to send a reminder only to those who teachers who have not completed it. The survey site will be active from April 1 to 30, 2003. The survey should take no more than 15 minutes to complete.

Instructions: To fill out the survey online, please click on or go to this link: http://coed.unomaha.edu/lschulte/vksurvey.htm Be sure to answer every question. More directions will be provided at the site. If you would prefer to fill out a paper form of the survey, click on this e-mail address and one will be sent to you via the school mail: techstaffdeveval@mpsomaha.org

Thank you for participating in the survey.

Sincerely,

Dr. Donna Flood
Director of Staff Development

Mrs. Vicki Kaspar
Assistant Principal
Online Survey of Technology (Flex) Training, 2002-2003 School Year

Demographic Information

(1) School ID
(2) Gender
   1. male
   2. female
(3) 2002-03 teaching assignment
   1. pre-school
   2. K-12 mixed
   4. 6-8
   5. 9-12
(4) Teacher’s age ________ (type in number)
(5) Years of teaching experience ________ (type in number)
(6) In 2002-03, I am teaching
   1. elementary education
   2. middle school mixed subjects
   3. art
   4. business
   5. family and consumer science
   6. foreign language
   7. industrial tech
   8. language arts
   9. math
   10. music
   11. science
   12. social studies
   13. special education
   14. other
(7) Technology class delivery method
   1. traditional tech classroom
   2. independent study
   3. online (Element K)
(8) Technology flex class taken for 02-03 ____________(type in class name)
(9) Past Technology Experience
   1. little experience
   2. small amount of experience
   3. moderate amount of experience
   4. large amount of experience
   5. extensive amount of experience
II. Survey

Please circle the number that most matches your response to the question.
1. Strongly disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

Need to Know

NK1. My tech flex class content was something that I needed to learn for my job.  
[ ] 1 2 3 4 5

NK2. The instructor or class introduction helped me understand the importance of learning about the class content.  
[ ] 1 2 3 4 5

NK3. I read articles about technology to gain insight or skills to supplement my learning.  
[ ] 1 2 3 4 5

NK4. I use technology to do my classroom assessments.  
[ ] 1 2 3 4 5

NK5. I use e-mail to communicate with other professionals inside my building.  
[ ] 1 2 3 4 5

NK6. I use e-mail to communicate with other professionals outside of my building.  
[ ] 1 2 3 4 5

NK7. I use e-mail to communicate with parents.  
[ ] 1 2 3 4 5

NK8. I know the process to locate tech resources in my building.  
[ ] 1 2 3 4 5

NK9. I know the process to locate tech resources in my district.  
[ ] 1 2 3 4 5

NK10. I use tech resources that help me provide differentiated instruction.  
[ ] 1 2 3 4 5

NK11. I use tech resources for student drill and practice.  
[ ] 1 2 3 4 5
1. Strongly disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

NK12. I have my students use the Internet as a research tool.

2. Self-concept

SC1. I had a choice about my product or project in my tech flex class.
SC2. I felt I was in charge of my learning in my tech flex class.
SC3. I had some input on the class content once I started my tech flex class.
SC4. I received positive reinforcement as I learned.
SC5. I had the opportunity to practice what I learned.
SC6. The lessons in the class were well prepared.
SC7. I experienced the curriculum that I expected.
SC8. I had accommodations for my special needs.
SC9. I was encouraged to ask questions.

3. Experience

E1. My tech flex class added to my technology knowledge and skill-base.
E2. A part of my class was sharing my previous technology experiences.
1. Strongly disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

E3. The degree of difficulty in my tech flex class was right for me, based on my experience.  

4. Readiness for Learning

RL1. I have the software to use what I learned in my class.  

RL2. I have people in my building to help me implement what I learned.  

RL3. My building has the hardware (computer availability, memory, speed) to use what I learned.  

RL4. The class choices were timely for me when I enrolled.  

RL5. The times that classes were offered were convenient for me.  

RL6. An eight-hour class gave me enough time to learn a new skill.  

5. Orientation for Learning

OL1. The instructor or online class explained how technology could help me create a product.  

OL2. The instructor or online class explained how technology could help me solve problems.  

OL3. What I learned in my tech flex class has nothing to do with my life or job.  

OL4. I changed my instruction due to what I learned in my tech flex class.
1. Strongly disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

OL5. I plan to use the new technology skills from class in the future.

OL6. What I learned in class helped me improve my students' achievement.

6. Motivation for Learning

ML1. I took this tech flex class because I needed to know more about the topic.

ML2. My principal expects me to use technology in my classroom instruction.

ML3. My principal expects me to use technology for student assessment.

ML4. My principal expects me to use e-mail to communicate with colleagues.

ML5. My principal expects me to use e-mail to communicate with parents who have e-mail.

ML6. My principal expects my students to use technology in my classes.

ML7. I have building incentives to use technology in my classroom.

ML8. I have district incentives to use technology in my classroom.
APPENDIX B

Institutional Review Board Approval of Study
Victoria Kaspar
14071 Drexel Circle
Omaha NE 68137

IRB#: 092-03-EX

TITLE OF PROTOCOL: Teachers' Perceptions of Technology Professional Development in a Suburban School District

Dear Ms. Kaspar:

The IRB has reviewed your Exemption Form for the above-titled research project. According to the information provided, this project is exempt under 45 CFR 46:101b, category 2. You are therefore authorized to begin the research.

It is understood this project will be conducted in full accordance with all applicable sections of the IRB Guidelines. It is also understood that the IRB will be immediately notified of any proposed changes that may affect the exempt status of your research project.

Please be advised that the IRB has a maximum protocol approval period of three years from the original date of approval and release. If this study continues beyond the three year approval period, the project must be resubmitted in order to maintain an active approval status.

Sincerely,

Ernest D. Prentice, Ph.D.
Co-Chair, IRB

EDP/gdk