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The Role of the School Administrators in Supporting Teachers in the Integration of Educational Technology Into K-12 Classrooms

Lisa M. Christensen Feldner

THE ROLE OF THE SCHOOL ADMINISTRATORS IN SUPPORTING TEACHERS IN THE INTEGRATION OF EDUCATIONAL TECHNOLOGY INTO K-12 CLASSROOMS

by

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This dissertation, submitted by Lisa M. Christensen Feldner in partial fulfillment of the requirements for the Degree of Doctor of Philosophy from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

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This dissertation meets the standards for appearance, conforms to the style and format requirements of the Graduate School of the University of North Dakota, and is hereby approved.

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Title	The Role of the School Administrators in Supporting Teachers in the Integration of Educational Technology into K-12 Classrooms
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ABSTRACT

While the role of the administrator has been regarded as significant in school improvement activities, little information exists which describes the specific roles and responsibilities of the administrator as a technology leader. This study is based on the premise that the role of the school administrator is crucial to the successful introduction and use of technology in the K-12 classroom. The purpose of the study was to examine relationships that may reflect the influence school administrators have on teachers' technology integration competencies. The study used transformational leadership theory, specifically Kouzes and Posner's (1985) five leadership practices, to examine the leadership by school administrators.

Data obtained from a U.S. Department of Education Technology Literacy Challenge Project was used in this study. The sample consisted of the K-12 teachers and administrators who participated in the North Dakota Teaching with Technology Initiative (ND TWTi). Participants included 89% of the K-12 teachers and administrators from 423 public and private schools throughout North Dakota. Data was collected using the Professional Competency Continuum surveys for both teachers and administrators developed by the Milken Exchange and the North Central Regional Technology in Education Consortium.

Data from the administrative competency ratings of administrators and teachers' technology integration competency ratings were tested using the Pearson correlation. The administrative competency indicators were (a) modeling effective use; (b) leading professional development; (c) leading and managing systemic change; and (d) maintaining a knowledge base. The teacher competencies included: (a) core technology skills; (b) curriculum, learning, and assessment; (c) professional practice; and, (d) classroom and instructional management. The correlations were significant beyond the .001 level between all administrative competencies and teachers' core technology skills and between teachers' professional practices. The correlations were significant at the .05 level between administrative competencies and teachers' curriculum, learning, and assessment, and teachers' classroom and instructional management. The correlations indicate that the administrative competencies of school administrators are likely determinants in the technology integration competency ratings of teachers under their leadership. As a result of the study, 14 recommendations for further study were made. Five recommendations for practical applications of the study were also provided.

CHAPTER I

INTRODUCTION

There is little argument that enormous amounts of money have been expended on computers and technology in schools. Between 1991 and 1997, $19.6 billion was spent on instructional technology in American public schools (Edvancenet, 1998). Lemke and Shaw (1999) estimate that $1.3 billion a year is spent nationally to support the infusion of instructional technology. A 1998 study conducted for the Milken Exchange on Education Technology (Solomon, 1998) found that among 1,990 districts in 21 states, 5.6 percent of their capital budgets, on average, were spent on technology as well as 3.4 percent of their operating budgets.

The infusion of capital has resulted in increased availability of technology in K-12 classrooms. Districts that have already made a substantial investment in wiring their classrooms now typically spend between 2 and 4 percent of their overall budget on technology; but many planners argue that even more should be spent (Solomon, 1998). In a study completed by the National Center for Educational Statistics (NCES, 2000), 99% of public school teachers reported having computers available somewhere in their schools, and 84% reported having at least one computer in each of their classrooms. Additionally, 95% of schools were connected to the Internet, with an average of one instructional computer with an Internet connection for every nine students (Williams, 2000).

As the number of computers and access to the Internet in schools has grown, so has the number of questions being asked about the extent to which those technologies are being used in schools and classrooms and for what purpose. A more contentious issue is the educational effectiveness of technology integration as a teaching/learning tool in the typical classroom. Survey results have indicated that, even after two decades in schools, teachers still do not feel prepared to integrate new technologies into their curriculum in rich and meaningful ways (Technology Counts, 1999). In recent years, policymakers have recognized that teachers and administrators need resources and organizational capacity to implement instructional reforms (CEO Forum on Education and Technology, 2000; U.S. Congress, Office of Technology Assessment, 1995; U.S. Department of Education, 1996). Knezek, Director of the Collaborative for Technology Standards for School Administrators, (2001) wrote,

> Integrating technology throughout a school system is, in itself, significant systemic reform. We have a wealth of evidence attesting to the importance of leadership in implementing and sustaining systemic reform in schools. It is critical, therefore, that we attend seriously to leadership for technology in schools. (p. 7)

In November of 2001, the Collaborative for Technology Standards for School Administrators released the Technology Standards for School Administrators. The reader can find the standards online at http://cnets.iste.org/tssa/index.html. These standards are a consensus among national educational stakeholders of what best indicates accomplished school leadership for comprehensive and effective use of technology in schools (Knezek, 2001). The impetus for the development of these standards was the recognition that administrators play a pivotal role in determining how well technology is used in our schools. Knezek (2001) asserts, "These Standards enable us to move from just acknowledging the importance of administrators to defining the specifics of what administrators need to know and be able to do in order to discharge their responsibility as leaders in the effective use of technology in our schools" (p. 3).

School administrators need a host of skills. One of the most important involves understanding change and the change process (Anderson & Dexter, 2000; Bailey, 2001). According to Bailey (2001), an expert on educational technology, the degree to which school administrators grasp the underpinnings of change will have a significant impact on their ability to assume an effective technology leadership role. While the role of the administrator has been highly touted as significant in school improvement activities, Bailey maintains little or no information exists which describes the specific roles and responsibilities of the administrator as a technology leader.

Statement of the Problem

As the critical issue of school technology utilization shifts from mere access to the more fundamental issue of how to integrate technology effectively into the curriculum, there has been little discussion of what role school administrators should play. This study is based on the premise that the role of the school administrator is crucial to the successful introduction and use of technology in the K-12 classroom. This view is supported by the landmark Apple Classrooms of

Tomorrow (ACOT) research conducted by Sandholtz, Ringstaff, and Dwyer (1997) who concluded that one of the key factors in whether or not teachers integrated technology into their classrooms was the level of support they received from school administrators. The National Center for Education Statistics (2000) also found that leadership by administrators is one of the most important factors contributing to the effective use of technology in classrooms.

The purpose of this study was to examine relationships that may reflect the influence school administrators have on teachers' technology skills and technology integration. The study was rooted in the theoretical constructs of both change theory in education (Fullan, 1991; Fullan, 1999) and transformational leadership theory (Burns, 1978; Kouzes & Pozner, 1987). The study used transformational leadership theory to examine the leadership by school administrators and the technology integration competencies of K-12 teachers in North Dakota.

Data obtained from a U.S. Department of Education Technology Literacy Challenge Project was used in this study. The research questions focused specifically on three of the five practices of Kouzes and Posner's (1987) contribution to transformational leadership theory: *a) Model the Way, b) Inspire a Shared Vision, c) Challenge the Process, d) Enable Others to Act, and e) Encourage the Heart.* A relationship between Kouzes and Posner's two practices, *Inspire a Shared Vision* and *Encourage the Heart*, could not be measured with the data captured for this study. Therefore, the investigator did not include those practices as part of the research questions. In the following paragraphs, each research question is aligned with the leadership practice from the theory base.

1. Is there a relationship between ratings of school administrators with regard to modeling effective use of technology and the technology integration competencies of teachers under their leadership? *a) Model the Way – Leaders create standards of excellence and then set an example for others to follow. By acting as role models, leaders inspire followers to put the good of the whole organization above self-interest* (Kouzes & Posner, 1987).

2. Is there a relationship between ratings of school administrators with regard to leading professional development and the technology integration competencies of teachers under their leadership? *d) Enable Others to Act – Leaders foster collaboration and build spirited teams. They actively involve others. Leaders create an atmosphere of trust. They make each person feel capable and powerful* (Kouzes & Posner, 1987).

3. Is there a relationship between the ratings of school administrators with regard to leading and managing systemic change and the technology integration competencies of teachers under their leadership? *c) Challenge the Process – Leaders search for opportunities to change the status quo. They look for innovative ways to improve the organization. They take risks* (Kouzes & Posner, 1987).

4. Is there a relationship between ratings of school administrators with regard to maintaining a knowledge base and the technology integration competencies of teachers under their leadership? *c) Challenge the Process – Leaders search for opportunities to change the status quo. They look for*

innovative ways to improve the organization. They take risks (Kouzes & Posner, 1987).

Significance of the Study

There have been numerous studies over the past decade on the use of technology in education. Unfortunately, there have been few studies on the role of the school administrator in the implementation of technology in schools. While the work of Bailey and Lumley (1993), Gibson (2000), Jackson (1996), Schiller (1997), and others is recognized here, the only large-scale study conducted in the past five years on this topic was by MacNeil and Delafield (1998). There is a need, therefore, to contribute additional findings to the knowledge base regarding the role of school administrators in leading teachers to more effectively integrate technology in their classrooms.

This study will be of interest to students, educators, state and local policymakers, and others interested in and/or concerned about the use of technology in instruction. In addition, the study will be of interest generally to practitioners, both administrators and teachers, as well as others concerned with technology, staff development, and leadership.

Delimitations of the Study

Although there are many factors that may affect the integration of technology into the K-12 curriculum, this study was focused only on selected factors that appear to relate to the influence of school administrators on such integration. This study was limited to K-12 teachers and school administrators in North Dakota.

Definition of Terms

Apple Classrooms of Tomorrow (ACOT): In 1985, Apple Computer Inc. began a partnership with several school districts across the United States. Its goal was to study how the routine use of technology by teachers and students might change teaching and learning. The ACOT research project concluded in 1998. After more than a decade of research, the ACOT project was one of the longest continuing educational studies of its kind (Sandholtz, Ringstaff, & Dwyer, 1997).

Educational technology: Hardware, software, and other technical equipment used in schools to support school functions, both administrative and instructional (Peterson, 2000, p. 9).

Inquiry-based learning: Students seek knowledge by questioning and investigating a phenomenon through hands-on experiences. Students critically examine the best evidence and report their findings, often leading to new questions and a repeat of the process (Teaching with Technology Initiative, 2002).

International Society for Technology in Education (ISTE): ISTE is the largest teacher-based, non-profit organization in educational technology. Its mission is to help K-12 classroom teachers and administrators share effective methods for enhancing student learning through the use of new classroom technologies.

Milken Exchange on Education Technology: The Exchange was formed in 1997 as part of the Milken Family Foundation's commitment to promoting responsible uses of educational technology in schools. Its mission is to enhance learning, and to bring resources that would not be possible without computers and other technology to help schools reach their own goals while continually assessing the impact of the technology upon their students.

North Central Regional Educational Laboratory (NCREL): NCREL is a not-for-profit, federally funded organization dedicated to helping schools, and the students they serve, reach their full potential. They specialize in the educational applications of technology.

North Central Regional Technology in Education Consortium (NCRTEC): NCRTEC is one of six regional technology in education consortia funded by the Office of Educational Research and Improvement of the U. S. Department of Education. Its mission is to help schools and adult literacy programs to develop technology-embedded practices that lead to improved and engaged learning for students.

Professional Competency Continuum (PCC): The PCC assesses the classroom behavior of educators, both administrators and teachers, in relation to national technology integration standards (Milken Exchange on Educational Technology, 1997).

Project-based learning: An end product is generally the driving force and often dictates how the project is organized. The production of the product requires specific content and skills and the entire process is authentic, mirroring the real world (Teaching with Technology Initiative, 2002).

Problem-based learning: Students work in groups to solve challenging problems that are authentic, curriculum-based, and often interdisciplinary.

Learners decide how to approach a problem and what activities to pursue (Solomon, 2003).

Technology integration: Students are learning about educational content. Knowledge of hardware and software systems is secondary. The technology fits comfortably with the teacher's instructional plans and philosophy and represents more an extension of them than an alternative or addition to them (Grabe & Grabe, 1998).

ND TWTi: Teaching with Technology Initiative. ND TWTi refers to a five-year Technology Innovation Challenge Grant awarded to the State of North Dakota (U.S. Department of Education, Office of Educational Research and Improvement, 1998). The data obtained from the initiative constitute the basis for this study.

CHAPTER II

REVIEW OF THE LITERATURE

The review of the literature will begin with a history of technology in education. The next section outlines critical views of educational technology followed by a section on student achievement. The review continues with sections on technology integration, on teacher change, and on administrative leadership, because all of these factors are likely to be involved in shaping use of technology in the classroom (Brunner, 1992; Honey & Moeller, 1990; Jackson, 1996; Office of Technology Assessment, 1995; Bailey, 1997). Transformational leadership, the theoretical base for the study, is explained in the sixth section. The seventh section compares leadership for technology integration and transformational leadership. A short summary of the technology and leadership sections is followed by the final section, which describes the setting, and the project, on which this study was based.

Historical Background of Technology in Education

In 1981, the National Institute of Education issued a report that stated, "Adapting to new technological realities is the most important policy issue facing public education during this decade" (Pogrow, 1981, p. 5). By the middle of the 1980s, the work place was undergoing a transformation unparalleled since the factory replaced the farm as the primary source of employment. The economy was shifting from an industrial base to one in which services would provide the vast majority of jobs in the future (Pogrow, 1985). Among services, the fastest-growing occupational category was related to the generation, processing, and distribution of information. This category included individuals who processed information in jobs ranging from clerical workers to highly technical computer programmers. Changes of this magnitude in the work place clearly posed implications for schools. Pogrow (1985) stated, "Schools must rethink their programs in terms of the new skills that they must provide to prepare students for radically different work worlds" (p. 3).

Computer technology entered the classroom with the introduction of the desktop computer in the 1980s. At this time, computers were mainly text-based with limited capabilities. Typically schools that invested in computers placed them in computer labs. Corporate leaders urged high school teachers to teach students to be "computer literate." Computer courses focused on computer literacy where students used programming languages to create simple computer programs (Thomas, 1999). Becker's (1985) national survey of schools showed computers were used primarily for three tasks: computer literacy (teaching students about computers), drill and practice, and learning to program.

In 1984, the national student-to-computer ratio was 92 students per one instructional computer (Peck, Cuban & Kirkpatrick, 2002) and 29% of students said they used a computer at school (Tapscott, 1998). Teachers indicated they used computers most frequently for enrichment or for computer literacy, but rarely for instruction in academic subjects (Becker, 1990).

By 1990, it was estimated that in 10 years 25% of all workers would work in information processing. An economy based on information requires workers who will know how to locate, analyze, manage, interpret, use, and present information in all of its formats. In response, Elizabeth Dole, then secretary of the Department of Labor, established the Secretary's Commission on Achieving Necessary Skills (SCANS) to answer the questions: what skills will prepare our youth to participate in the modern workplace, and what skill levels do entry-level jobs require? The report, published in 1991, notes that workers will need to be lifelong learners who possess skills beyond those of reading, writing, and arithmetic. The Commission (1991) concluded that due to the global nature of the economy and the impact of technology, good jobs would increasingly depend on people who could put knowledge to work. "Given that the economy will be based on information, it is incumbent upon our educational system, from kindergarten through adult education, to incorporate information literacy skills instruction within the content areas" (SCANS, 1991, p. xv).

By 1994, the federal Goals 2000 legislation (United States General Accounting Office, 1994) was put in place to support systemic change in education including the increased use of technology. The legislation addressed the need for states to develop plans that discussed how technology would assist with the educational reform process.

Spitzer, Eisenberg, and Lowe (1998) stated that both the SCANS report and Goals 2000 were policy statements. Both policies agreed on much of what was needed: greater focus on teaching all students to become independent lifelong learners, to become critical thinkers, to use a variety of technologies proficiently, and to work effectively with others. In effect, all students should be prepared to use information literacy to solve problems in their personal lives as well as in school and in the workplace.

In his Technology Literacy Challenge (1996), President Clinton professed that our national education and technology objectives must include improvements in "Four Pillars": hardware, connectivity, digital content, and professional development. "These Four Pillars provide a foundation for creating an innovative learning environment where students and teachers can reach beyond the confines of a single school building for information, interaction, and enrichment" (CEO Forum, 1997, p. 2). The President's Committee of Advisors on Science and Technology (1997) recommended that four or five students to one computer would to be an adequate ratio for effective computer use in schools. In 1998, the Milken Exchange on Education Technology, a leader in the study of technology in schools, predicted the public would need to invest $5 billion nationwide on "learning technology" to meet the perceived needs (Lemke & Coughlin, 1998).

In response, schools began to wire their buildings for connectivity and Internet access and expend greater amounts of money on technology. "Net Days" were organized by volunteers, parents, educators, and businesses to wire schools for connectivity. It was estimated schools purchased $88.19 million worth of instructional hardware, software, and connectivity throughout the 1998-99 school year (CEO Forum, 1999). Calculated by dividing total school computers by student population, the national student to computer ratio had decreased from 92 students per computer in 1984 to 5.4 in 2001 (Peck et. al. 2002). With regard to Internet access, in 1994, 35% of U.S. schools were connected to the Internet; by 1999, that number had increased to 90% (NCES, 2000). According to recent Benton Foundation reports, the US has spent $38 billion over the past 10 years to bring technology and Internet connectivity to the nation's schools (Solomon, 2002).

Critics of Educational Technology

The use of technology in education has a variety of critics. Some, like Stoll and Evans, are openly opposed to the integration of technology in education. Stoll (1999) wrote,

> I shrug when businesses blow fortunes on dubiously useful geegaws, but I'm furious to watch our schools sold down the river of technology. I believe a good school needs no computers. . . That students, justifiably, recognize computer assignments primarily as entertainment, rather than education. That in times of shrinking education budgets, it's an outrage to pour limited funds into fast-obsoleted computers. (p. xiii)

Stoll alleges teachers need only open a closet door to find stacks of obsolete and unused teaching gizmos: filmstrips, instructional television systems, Apple II computers, and any number of educational videotapes. Further, each promised a revolution in the classroom and none delivered.

Evans (2002) believes the technology in schools movement has created its own momentum and there is little room or patience for any reflection or discussion. He believes technology threatens to diminish qualities such as self-discipline, sustained concentration, and in-depth deliberation. He continues, "Sound bites, cable news, bumper stickers, and 'surfing the Net' are a few examples of our growing propensity to avoid complexity, substance, and the hard work of thinking" (p. 37).

Others are not critical of the technology, but rather, the way in which it has been addressed in schools. Cuban (1999) wrote after examining the use of technology in the classroom, "We find that these powerful technologies end up being used more often for word processing and low-end applications. And this is after a decade of increases in access to computers, Internet capability, and purchases of software" (p. 68).

The expenditures on educational technology and the lack of significant change did not go unnoticed. Bozeman and Spuck (1991) noted the promise of computer-based education, coupled with rapidly declining costs of the technology, has resulted in many possibilities for curricular reform. Regrettably, they noted, the intelligent integration of technology into the curriculum of American schools was not commonplace.

Technology Effects on Student Achievement

While technology has fundamentally changed the way we live and work, concern is mounting that it has not affected the way we learn. "Now we need to apply technology's powerful tools to change the way our students, of every age, learn" (CEO Forum, 1999, p. 1). This speaks to the impact of technology on student achievement -- an issue that raised its head almost as soon as schools began channeling resources to technology -- the question is still under investigation. Pisapia and Perleman's (1992) meta-analysis of 184 studies on the impact of technology on student performance found: (a) 32% of 184 studies reported technology had a negligible effect, (b) 19% reported a moderate effect, and (c) 49% reported a substantial effect on student learning.

Kulik (1994) drew three conclusions from his meta-analysis of more than 500 studies on computer-based instruction: (a) students learned more in less time in classes that included computer-based instruction, (b) students liked their classes more and developed more positive attitudes toward computers when their classes included computer-based instruction, (c) computers did not, however, have positive effects in every area in which they were studied. In 34 of the studies that examined students' attitudes toward subject matter, the average correlation of computer-based instruction was near zero. On the other hand, Cradler's (1994) review of over 100 studies found technology to have a positive impact on student achievement in the areas of problem-solving, writing, vocational, and work force skills.

The Software Publishers Association commissioned a consulting firm to analyze 176 studies, conducted from 1990 to 1995, on the effectiveness of technology in schools. The report shows students in technology-rich environments experienced positive effects on achievement in all major subject areas, for both regular and special-needs students. The study also found that educational technology helps improve students' self-esteem and attitudes toward learning, especially when it is used in conjunction with other educational reforms such as collaborative learning (Sivin-Kachala & Bialo, 1994).

In a five-year longitudinal study conducted in West Virginia, Mann, Shakeshaft, Becker, and Kottkamp (1998) followed students from kindergarten to grade five to examine the impact of technology on learning. Their findings indicate the effective use of learning technology has led directly to significant gains in math, reading, and language arts skills. In a four-year study conducted for the U. S. Department of Education's Office of Educational Research and Improvement, researchers set out to understand how technology can support constructivist teaching at the classroom level (Means, Blando, Olson, Middleton, Morocco, Remz, & Zorfass, 1993). The schools in the study all served substantial numbers of disadvantaged students. The researchers found that increases in technology had positive effects on these schools, leading to increased motivation and improvements in academic performance. Seven of the eight schools in the study reported lower teacher turnover, six reported higher student achievement rates, and five had higher test scores than a comparison group. Interestingly, a recent study by Kulik (2002) found that when used effectively, computer drills and tutorials can improve student performance in math and science—but the benefits of computer simulations and electronic sensors are less tangible.

What might account for the inconsistent findings in the literature? Researchers at NCREL, Honey, Culp, and Spielvogel (1998), have suggested that it is difficult to measure the impact of instructional technology because its use frequently correlates to changes in other educational factors. Originally the determination of student achievement was based on traditional methods of social scientific investigation that asked whether there was a specific, causal relationship between one thing--technology--and another--student achievement. Isolating the use of instructional technology as a variable that impacts student learning remains a challenge for researchers. Because schools are complex social environments, it is impossible to change just one thing at a time (Cuban & Kirkpatrick, 1998). If a new technology is introduced into a classroom, other things also change. For example, teachers' perceptions of their students' capabilities can shift dramatically when technology is integrated into the classroom (Honey & Moeller, 1990); also, teachers frequently find themselves acting more as coaches and less as lecturers (Sandholtz et al., 1997). Another example is that use of technology tends to foster collaboration among students, which in turn may have a positive effect on student achievement (Honey et al., 1999). Because the technology becomes part of a complex network of changes, its impact cannot be reduced to a simple cause-and-effect model that would provide a definitive answer to how it has improved student achievement (Honey et al., 1999). Cuban and Kirkpatrick (1998) noted that technology cannot be easily separated from curriculum, pedagogy, and teaching skills in determining the source of an educational outcome. It is, therefore, difficult to measure the impact of technology alone when one or more of these changes occur.

Integrating Technology into the Classroom

Are teachers effectively using technology in the classroom? In the early days of computers in classrooms, it was hoped technology would bring about the same successful transformation that had been seen in science, industry, and business. In science, automated computation allowed measurement and analysis never before possible. Simulations allowed for experimentation without harming existing environments. In industry, robots replaced humans in repetitious processes eliminating the errors and hazards that come with human boredom. In business, the flexibility of the word processor over the typewriter and the spreadsheet over the calculator was immediately obvious. In each of these fields, clear procedures combined with technology led to quantum leaps in efficiency (Sandholtz et al., 1997).

Technology's role in schooling was not so obvious. When computers were first introduced to classrooms, reformers focused on computers and software. They gave little thought to how technology would integrate into instruction (Sandholtz et al., 1997). In their study on technology leadership, Anderson and Dexter (2000) defined integration as the degree to which teachers throughout the school have incorporated computers into their everyday responsibilities. Becker (1990) defined technology integration as the meaningful and authentic use of technology to support teachers' and schools' instructional goals.

In 1995, the Office of Technology Assessment of the US Congress put it succinctly, "Helping teachers use technology effectively may be the most important step to assuring that current and future investments in technology are realized" (1995, p. 2). The report went on to note that effective use means integration of technology by teachers throughout curriculum and instruction.

Similarly, the President's Committee of Advisors on Science and Technology Panel on Educational Technology (1997) reported,

> Focus on learning *with* [italics added] technology, not *about* [italics added] technology. Although both are worthy of attention, it is important to distinguish between technology as a subject area and the use of technology to facilitate learning about any subject area. While computer-related skills will unquestionably be quite important in the twenty-first century, and while such skills are clearly best taught through the actual use of computers, it is important that technology be integrated throughout the K-12 curriculum, and not simply used to impart technology-related knowledge and skills. Although universal technological literacy is a laudable national goal, the Panel believes the Administration should work toward the use of computing and networking technologies to improve the quality of education in all subject areas (para. 4).

A study by the Organization for Economic Cooperation and Development (2002) found that although American students have greater access to technology overall than their peers in other countries, many teachers still do not know how to use computers effectively as a learning tool. The Organization (2002) reports,

> Many teachers are struggling to find the right way to integrate their newly acquired tools with the teaching skills they have used for many years. Simply having good tools available will always be insufficient to produce

excellence. Before technology will achieve its potential in the classroom, teachers will need to become master artisans in its use (p. 3).

As availability of technology has grown, so has the number of students and teachers using computers and the frequency with which they use them (Levin, 1998). However, the advent of computers and the Internet has not dramatically changed how teachers teach and how students learn. According to studies by Becker (1990, 1994), teachers typically have used computers for traditional methods of instruction, such as drill and practice and computer education. More recent studies by Becker (1999) and NCES (1999) indicated that teachers' use of technology reflected a mixture of traditional and innovative teaching methods. For example, teachers frequently assigned students to use computers for drill and practice, word processing, or spreadsheets. However, they also assigned students to use computers and the Internet for research, solving problems, and analyzing data.

Commonly cited reasons for the lack of success in integrating technology are expertise and support (Colburn, 2000; Hanby, 2000). A National Education Association survey shows that despite 94% of all respondents claiming familiarity with computers and the Web, teachers say they lack the skills to integrate technology in their teaching (Solomon, 2002). In 1999, only a third of teachers reported they felt well-prepared to integrate technology into classroom instruction (CEO Forum, 1999; NCES, 2000). In addition, many researchers have suggested that the lack of high quality teacher training is a major factor impeding the integration of technology in education (Bailey, 1996; Darling-Hammond, 1998; NCES, 2000).

In their study of technology in schools, the Southern Technology Council (1997) found that technology brings changes to organizations. It changes role relationships, demands new skills, alters definitions of jobs and work responsibilities, and calls for new kinds of leadership. The Council (1997) states, "The message is clear: one needs to attend to the organizational and people-changing aspects of introducing technology" (p. 14).

Educational Change

Effective implementation of technology requires a change in culture -- one that encourages people to think differently about the teaching and learning processes and the possibilities for technology use (NCREL, 2001). Coughlin and Lemke (1999) assert that many of the opportunities for significant change in the way schools use technology are linked to change in the school culture.

Researchers (Fullan, 1996; Sergiovanni, 1996) have begun to question whether we are meeting the varied educational needs of all students. Each has suggested that there are major changes that need to occur in schools if we are to meet the needs of students now and in the future. Fullan (1996) suggests that the values, beliefs, and norms of schools need to be examined to determine whether the existing culture of the school is preparing students for participation in a complex society. Hargreaves & Fullan (1998) state,

> There is no avoiding the central issue. Even with new technologies, no significant changes will occur for students unless we have more and better

discussions about how to transform and improve teaching and learning in our schools so that students develop deep understanding and can apply what they know to new situations. (p. 78)

According to the International Society for Technology in Education (2000), traditional educational practices no longer provide students with all the necessary skills for economic survival in today's workplace. New learning environments must provide opportunities for students to find and utilize current information and resources and apply academic skills for solving real-world problems. Figure 1 lists characteristics representing traditional approaches to learning and the corresponding strategies associated with new learning environments. These environments engage students in activities that have educational technology skills and relevant curricular content interwoven (ISTE, 2000). Transforming their teaching to accommodate these new environments is a major change for most teachers (Maddin, 2002). It adds a new level of complexity to the teaching practices of teachers. Educational change is especially complex because schools must deal with multiple changes concurrently (Sandholtz et al., 1997). Yet, regardless of what type of change is desired, teachers are integral to any changes in schools. The challenge to technology integration is posed when teachers must acquire new skills while concurrently changing their approach or style of teaching to accommodate the use of new materials.

Traditional Learning Environments →	New Learning Environments
Teacher-centered instruction	Student-centered instruction
Single-sense stimulation	Multisensory stimulation
Single-path progression	Multipath progression
Single media	Multimedia
Isolated work	Collaborative work
Information delivery	Information exchange
Passive learning	Active/exploratory/inquiry-based learning
Factual, knowledge-based learning	Critical thinking/informed decision-making
Reactive response	Proactive/planned action
Isolated, artificial context	Authentic, real-world context

Figure 1. The Shift from Traditional Learning Environments to New Learning Environments Associated with Instructional Technology Integration (ISTE, 2000)

Complexity is also reflected in the National Educational Technology Standards for Teachers (2000), which defines six areas of competency for all classroom teachers. The standards state that all classroom teachers should be prepared to:

1. Demonstrate a sound understanding of technology operations and concepts;
2. Plan and design effective learning environments and experiences supported by technology;
3. Implement curriculum plans that include methods and strategies for applying technology to maximize student learning;

4. Apply technology to facilitate a variety of effective assessment and evaluation strategies;
5. Use technology to enhance their productivity and professional practice; and,
6. Understand the social, ethical, legal, and human issues surrounding the use of technology in PK-12 schools and apply that understanding in practice. (International Society for Technology in Education, 2000, p. 9)

Teachers have always been responsible for establishing the classroom environment and preparing the learning opportunities for students. Now, that environment must facilitate student use of technology to learn, communicate, and develop products. Schools and classrooms must have teachers who are equipped with technology resources and skills and who can effectively teach the necessary subject matter content while incorporating technology concepts and skills (ISTE, 2000).

Hargreaves & Fullan (1998) state, "We have no choice in deciding whether technology will affect us. The only choice is figuring out how we will change ourselves and each other to respond to it and turn it to our advantage" (p. 9).

Transformational Leadership

The study of leadership can aptly be described as "leadership: examining the elusive". This also happens to be the title of the Association of Supervision and Curriculum Development Yearbook (ASCD) published in 1987 which covers the theories of leadership for education (Scheive & Schoenheit, 1987). Developing the consummate theory of leadership has been an elusive quest for researchers and theorists since the early 1900s. Even today, numerous books are published that promote new leadership strategies and concepts.

Until the 1970s, there were essentially two leadership paradigms: the trait perspective, and the behavioral approach. The trait perspective suggested that leaders were born with inherent leadership qualities such as intelligence, ability, personality, and physical appearance (Hersey, Blanchard, and Johnson, 1996). In order to identify potential leaders, it would be necessary to identify and measure these leadership qualities. In other words, leaders were born, not made.

Ultimately, research on the trait approach yielded few consistent findings. Jennings concluded, "fifty years of study have failed to produce one personality trait or set of qualities that can be used to discriminate between leaders and nonleaders" (In Hersey, Blanchard, and Johnson, 1996, p. 101). On the other hand, Bennis and Nanus (1985) completed a five-year study of ninety leaders, and on the basis of this research were able to identify four common qualities shared by all ninety leaders. Their findings resulted in the movement from the trait approach to that of the behavioral approach to leadership theory. After studying 500 leaders, Kouzes and Posner (1987) found that leadership was an observable, learnable set of practices.

> It's not the absence of leadership potential that inhibits the development of more leaders; it's the persistence of the myth that leadership can't be learned. This haunting myth is a far more powerful deterrent to leadership

> development than is the nature of the person or the basics of the leadership process. (Kouzes & Pozner, 2002, p. 387)

Hersey and Blanchard (1993) maintained that because leadership is a dynamic process, varying from situation to situation, there is no universal set of traits that ensure leadership success. However, there may be traits that help or hinder in a given situation.

The lack of validation of trait approaches led to other investigations of leadership. Among the most prominent areas were the behavioral approaches. Behavioral leadership allows for the possibility that individuals can be trained to adapt their style of leader behavior to varying situations (Sergiovanni, 1987). Sergiovanni (1987) observed that this style of leadership resulted in the development of highly structured management systems. In the behavioral category is Hersey and Blanchard's (1993) theory of situational leadership. This theory is based on the dimensions of task and relationship behavior. They identified four basic leadership styles that apply to their followers in given situations: high task and low relationship, high task and high relationship, low task and high relationship, and low task and low relationship. In each circumstance, leaders then must be able to identify behaviors and adapt to the given situation. Sergiovanni (1987) explains that the behavioral approach to leadership was eventually pushed aside by newer, transformational leadership perspectives. He continues, "Now what leaders stand for and believe in, and their ability to communicate these values and ideals in a way that provides both meaning and significance to others, is more important than how they behave" (p. 117).

The idea of transformational leadership was first reported by James McGregor Burns in 1978. According to Burns (1978), leadership is exercised when persons with certain motives and purposes mobilize resources to arouse and satisfy the motives of followers. He identified two kinds of leadership, transactional and transformative. Transactional leadership focuses on basic and extrinsic motives and needs, and transformative on higher-order, more intrinsic motives and needs.

In transactional leadership, leaders and followers exchange needs and services in order to accomplish independent objectives. The objectives may be related but they are separate nonetheless (Burns, 1978). This exchange process if often viewed as a form of leadership by bartering (Sergiovanni, 1990). The wants and needs of followers and the wants and needs of the leader are traded and a bargain is struck.

In transformational leadership, by contrast, leaders and followers are united in pursuit of higher-level goals that are common to both. Both want to become the best. In Burns (1978) words, "Such leadership occurs when one or more persons engage with others in such a way that leaders and followers raise one another to higher levels of motivation and morality" (p. 20). Bass (1990) described transformational leadership as that which occurs when leaders broaden and elevate the interests of their followers, when they generate awareness and acceptance of the purposes and the mission of the group, and when they stir their followers to look beyond their own self-interest for the good of the group.

Epitropaki (2002) summarized transformational leadership as follows:

> Transformational leaders have a clear collective vision and most importantly they manage to communicate it effectively to all followers. By acting as role models, they inspire followers to put the good of the whole organization above self-interest. They also stimulate followers to be more innovative, and they themselves take personal risks and are not afraid to use unconventional, but ethical, methods in order to achieve the collective vision. This form of leadership goes beyond traditional forms of transactional leadership that emphasized corrective action, mutual exchanges, and rewards only when performance expectations were met. Transactional leadership relied heavily on centralized control. Managers controlled most activities, telling each person what, when, and how to do each task. Transformational leaders, on the other hand, trust their subordinates and leave them space to breath and grow. (p. 1)

Kouzes and Posner (1987) indicated, "if there is a clear distinction between the process of managing and the process of leading, it is the distinction between getting others to do and getting others to want to do" (p. 27). For Kouzes and Posner, the difference between transactional and transformational leadership is the difference between managing and leading. Managers (transactional) honor stability and control through systems and procedures. Leaders (transformational) thrive on change; exercise "control" by means of an inspiring vision of what might be, arrived at jointly with their followers; and understand that empowering people by expanding their authority rather than standardizing them by shrinking their authority is the only course to sustained relevance and vitality (Kouzes & Posner, 2002).

Strategies and Characteristics of Transformational Leaders

Many of the current leadership researchers have identified characteristics, behaviors, and/or strategies that are present in successful leaders. From their study of 90 leaders, Bennis and Nanus (1985) identified four areas of competency that all ninety leaders possessed: attention through vision, meaning through communication, trust through positioning, and the deployment of self through positive self-regard. Bennis (1989) explains that leaders manage attention through a compelling vision that brings others to a place they had not been before. Meaning through communication is the ability to influence, organize, and communicate meaning for the members of the organization. Trust through positioning means the leader's positions are clearly articulated. People tend to trust leaders when they know where the leader stands in relation to the organization. Finally, Bennis and Nanus (1985) defined deployment of self as the leaders' ability to capitalize on strengths and compensate for weaknesses to effectively lead the organization.

Sergiovanni (1990) identified four stages of leadership for school improvement: bartering, building, bonding, and banking. In bartering, the leader and the follower strike a bargain in exchange for something they both want. Building is accomplished when the leader provides the climate and support that enhances followers' opportunities for achievement, responsibility, competence, and esteem. Bonding results when the leader and the follower develop a set of shared values and commitments that bond them together in a common cause. Lastly, banking seeks to make school improvements routine thus conserving human energy and effort.

In 1987, Kouzes and Posner reported the findings from their study of 500 mid- and senior-level managers who were identified as leaders. From their research, Kouzes and Posner (1987, 2002) identified Five Practices of Exemplary Leadership and 10 commitments common to leadership:

- *Model the Way.*
  1. Find your voice by clarifying your personal values.
  2. Set the example by aligning actions with shared values.
- *Inspire a Shared Vision.*
  3. Envision the future by imagining exciting and ennobling possibilities.
  4. Enlist others in a common vision by appealing to shared aspirations.
- *Challenge the Process.*
  5. Search for opportunities by seeking innovative ways to change, grow, and improve.
  6. Experiment and take risks by constantly generating small wins and learning from mistakes.

- *Enable Others to Act.*
    7. Foster collaboration by promoting cooperative goals and building trust.
    8. Strengthen others by sharing power and discretion.
- *Encourage the Heart*
    9. Recognize contributions by showing appreciation for individual excellence.
    10. Celebrate the values and victories by creating a spirit of community. (p. 13)

Over 178 validation studies conducted by Kouzes and Posner (1987), as well as other researchers, over a 15-year period consistently confirm the reliability and validity of the Five Practices of Exemplary Leaders model (Kouzes & Posner, 2002). Internal reliability, as measured by Cronbach's Alpha, is strong, with all scales above the .75 level. An extensive library of the studies and statistical methods used to provide reliability and validity data is available on the URL, http://www.leadershipchallenge.com/research. The Five Practices of Exemplary Leadership provided the framework for this study. The practices were applied to leadership in the integration of technology and are examined in greater detail in the next section.

Technology Integration and Transformational Leadership

The following section is intended to show the reader how transformational leadership is inherent in the integration of technology in K-12 education. Kouzes and Posner's (1987, 2002) five leadership practices: *Model the Way, Inspire a*

Shared Vision, Challenge the Process, Enable Others to Act, and *Encourage the Heart* are used as the framework.

Today, computers and networks are an integral part of daily instructional and administrative school district operations. As a result, technology leadership from district and building-level administrators is essential. Mergendoller (1994) reports that for technology to become diffused across a district, administrative leadership is critical. Research finds that administrators play a critical role in the implementation and use of technology in schools (Becker, 1992; Bosco, 2002; Bozeman & Spuck, 1991; Mergendoller, 1994; Office of Technology Assessment, 1995; Peterson, 2000; Sandholtz et al., 1997).

Coughlin and Lemke (1999) maintain that administrators must model technology use; initiate and support professional development with regard to technology implementation; lead systemic change; and maintain knowledge of the application of technology to student learning. In addition, the Southern Technology Council's (1997) national study of schools that have effectively implemented technology found best practices in school leadership included four dominant themes: vision, support, modeling technology use, and interacting.

From the ACOT research, Sandholtz et al. (1997) found that administrative support was crucial in determining whether or not teachers integrated technology in their classrooms. They found:

> (a) by making technology use a priority, administrators reduced barriers to technology integration such as insufficient time for continued learning, limited access, and lack of technical support; (b) by showing interest in

changes teachers were instituting in their classrooms, administrators offered their teachers much needed emotional and moral support; (c) by encouraging teachers to take positions of leadership, administrators increased the likelihood that teachers would share what they had learned with their colleagues; and (d) by working with their staff to create a shared vision for the future, administrators eased tensions among teachers and fostered teacher collaboration rather than competition (Sandholtz et al., 1997, p. 179-180).

A study in Texas by MacNeil and Delafield (1998) examined principal leadership for successful school technology implementation. This study was one of the first focused research studies carried out in this area. One hundred and twelve principals and assistant principals were surveyed. The majority of principals viewed technology as very important in their schools, and that it was important for teachers to utilize and learn technology as a curriculum tool. The findings of the study included: (1) The main barriers to implementing technology in the classroom were lack of financial resources, poor infrastructure, and lack of time for professional development and planning; (2) a closer alignment between the amount of time given for professional development and its perceived importance is needed; (3) funding, training and leadership issues must be addressed simultaneously if technology in the curriculum is to grow and have a significant impact on the reform of education; and (4) principals and school leaders must accept the challenge to create supportive conditions that foster innovative use of computers.

General leadership themes combined with a technology focus rise from the aforementioned literature: vision, administrative support, modeling technology use, collaboration, professional development, leading systemic change, and knowledge of technology's application to student learning. These themes will be compared to Kouzes and Posner's (1987) five leadership practices in the following subsections.

Model the Way

Transformational leaders must be models of the behavior they expect of others. By acting as role models, transformational leaders inspire followers to put the good of the whole organization above self-interest (Bass, 1990). Exemplary leaders go first -- they *Model the Way.* They set the example through daily actions that demonstrate they are deeply committed to their beliefs (Kouzes & Posner, 2002). *Modeling the Way* is about earning the right and the respect to lead through direct individual involvement and action. "People first follow the person, then the plan" (Kouzes & Posner, 2002, p. 15).

Leaders must model the use of technology to further the change process. Bailey & Lumley (1997) teach that leaders have to model technology use to be successful technology leaders. Likewise, Cafolla and Knee (1995) believe that the successful leader is a strong advocate and user of technology. Only by modeling computer use will the leader be able to convince teachers of the importance of technology. In Schiller's (1997) study of school administrators' use of technology, all respondents commented on the significance of them modeling appropriate uses of technology and its use in their daily work lives. Similarly, research by the Office of Technology Assessment (1995) found that when administrators are informed and comfortable with technology, they become key players in leading and supporting technology integrations activities in their schools.

Bozeman and Spuck (1991) report that if the principal is to be a true instructional leader, knowledge of instructional technology is essential. Costello (1997) found that administrators need to model the use of technology to change and improve the environment in which educators function. Coughlin & Lemke (1999) agree that if technology is to be woven transparently into the daily activities of classrooms, the use of technology should be modeled by professionals throughout the school community.

In Wilburg's (1991) case study of three schools identified as successful integrators of technology, it was found that in all three cases, the administrator was a strong advocate and user of computer technology. This seems to support the notion that administrative modeling may be one key to integrating technology. In addition, Peterson (2000) found that principals of technology-rich schools classify word processing, electronic mail, Internet search engines, and navigation tools as very important for effectively performing their professional responsibilities. Whether leading by example or by enabling others, principals can play critical roles in sparking the implementation of instructional technology (Peterson, 2000).

Inspire a Shared Vision

Kouzes and Posner (2002) stated, "Leaders cannot command commitment, only inspire it" (p. 15). People will not follow until they accept a vision as their own. "Leaders breathe life into the hopes and dreams of others and enable them to see the exciting possibilities that the future holds" (Kouzes & Posner, 2002, p. 16). According to Bennis and Nanus (1985), "a vision articulates a view of a realistic, credible, attractive future for the organization, a condition that is better in some important ways than what now exists" (p. 89). Leaders accomplish acceptance of their vision by getting to know people's dreams, hopes, aspirations, visions, and values (Kouzes & Posner, 2002).

Leaders overcome resistance to change by creating visions of the future that evoke confidence in and mastery of new organizational practices (Bennis & Nanus, 1985). Vision seems to bring about a confidence on the part of employees, a confidence that instilled in them a belief that they were capable of performing the necessary acts. Vision animates, inspires, and transforms purpose into action. A shared vision of the future also suggests measures of effectiveness for the organization and for all its parts. It helps individuals distinguish between what's good and what's bad for the organization and what's worthwhile to achieve (Bennis & Nanus, 1985).

Solomon (2002), a widely recognized expert in educational technology, asserts that leaders need to have a clear vision of how technology can make a difference in student learning. Likewise, the Office of Technology Assessment (1995) identified a shared vision for the use of technology to support curriculum as a factor in the effective use of technology by teachers. In addition, the ACOT research revealed that administrators who worked with their staff to create a shared vision, eased tensions among teachers and fostered teacher collaboration rather than competition (Sandholtz et al., 1997). Perry and Areglado (2001) maintained that leadership for technology transformation begins, rather than ends, when technology arrives at the school. Moving from installation to transformational use urges principals to be intentional, which requires an instructional vision and a strategy for implementation. Essential to this vision is an emphasis on meaningful, engaged learning with technology, in which students are actively involved in the learning process. Students take ownership of their learning, acting as explorers and producers; teachers function as facilitators and guides (Cradler, 1994; Glennan & Melmed, 1996; Means et al., 1993).

Challenge the Process

Transformational leaders are willing to take risks and make mistakes. Bennis (1989) found that effective leaders encourage risk taking by creating environments that encourage it. Bennis (1993) stated, "Leaders create a climate in which conventional wisdom can be challenged, and one in which errors are embraced rather than shunned in favor of safe, low-risk goals" (p. 168). Kouzes and Posner (1987) relate that leaders search for opportunities to innovate, grow, and improve. They know that innovation and change all involve experimentation, risk, and failure. They pay attention to the capacity of their constituents to take control of challenging situations and become fully committed to change. Bennis

(1993) found that true leaders try to obtain the trust of their co-workers, clearly articulate their vision, and then involve everyone in the change process.

The leadership must identify the key players and power holders in the organization and in its operating environment and obtain support for the change. The leader must be fully committed to the transformation and the commitment must be visible to other organizational members and key players (Hersey, Blanchard, & Johnson, 1996). Leadership must be willing to risk the introduction of structural changes and the acquisition and allocation of resources that will secure the competence and commitment to make the transformation work. Leithwood (1992) found that transformational leaders helped teachers solve problems more effectively. Transformational leadership is valued by some because it stimulates teachers to engage in new activities and put forth that "extra effort" (Leithwood, 1992; Sergiovanni, 1987). Also, Leithwood (1992) found that transformational leaders use practices primarily to help staff members work smarter, not harder. In addition, he found that leaders believe staff members as a group could develop better solutions than the principal could alone.

Costello (1997) focuses on two key points. As school districts plan for technology, they must keep in mind two issues: (a) technology has the potential to change how we work, teach, and learn in our school districts; and (b) this potential will only be realized if administrators assume the lead role in realizing this potential.

Successful instructional transformation obliges leaders to be actively involved in all aspects of the process. Active involvement allows leaders to send the implicit and explicit messages that create a sense of urgency, guide the implementation strategy, and create change in the whole school (Perry & Areglado, 2001). Visiting model sites or attending presentations by other administrators who have led successful, technology-supported change initiatives can assist in leading systemic change (Coughlin & Lemke, 1999). The administrator's direct involvement does not ensure success, but its absence guarantees failure in the quest for improved instruction through technology (Perry & Areglado, 2001).

Enable Others to Act

Kouzes and Posner (2002) found that leaders foster collaboration and build trust. They *Enable Others to Act*. Sergiovanni (1990) suggests that enabling is practiced when means and opportunities are provided and obstacles are removed thus permitting people to be successful. Bass and Avolio (1993) report that leaders pay special attention to each individual's needs for achievement and growth by acting as coaches or mentors. Kouzes and Posner (1987) wrote,

> The effect of *Enabling Others to Act* is to make them feel strong, capable, and committed. Those in the organization who must produce the results feel a sense of ownership. They feel empowered, and when people feel empowered, they are more likely to use their energies to produce extraordinary results. (p. 11)

Leithwood (1992) finds that transformational leaders pursue helping staff develop and maintain a collaborative, professional school culture. This means staff members often talk, observe, critique, and plan together. Leithwood reports that transformational leaders involve staff in collaborative goal setting, reduce teacher isolation, support cultural changes, share leadership with others by delegating power, and actively communicate the school's norms and beliefs. Hersey, Blanchard, and Johnson (1996) maintain leaders must identify the key players and power holders in the organization and obtain support for the change. Leithwood (1992) found that transformational leaders foster teacher development. One of his studies suggests that teachers' motivation for development is enhanced when they internalize goals for professional growth. This process, Leithwood found, is facilitated when they are strongly committed to a school mission.

The ACOT research provides evidence about the importance of principal and administrative support (Sandholtz et al., 1997). Principals in participating schools were required to provide time for teachers to plan together and reflect on their practice; to give recognition for teachers' efforts; and to ensure that teachers had the authority and flexibility to make instructional and curricular adjustments. The most crucial factor determining whether participating teachers successfully integrated technology into their classroom was the level of support they received from school and district administrators (Sandholtz et al., 1997). These findings are consistent with research conducted by the Office of Technology Assessment (1995). In similar fashion, Gibson (2000) found in a study of schools in the Midwest, that the administrator plays a key role in supporting teachers as they integrate technology into their teaching practices. Perry and Areglado (2001) concur that support by the principal is necessary to help teachers overcome obstacles and integrate technology into their instructional practice. Similarly, Becker's findings (1999) confirm that successful integration of technology into the classroom requires the availability of quality technology support. Support is not just technical support but, in large part, instructional support that includes individualized training and professional development that focuses on instruction and integration.

As teachers begin using technology for more sophisticated purposes, instructional support is as essential as technical support. (White, Ringstaff, & Kelley, 2002). Teachers' use of technology suggests as they become more and more proficient at integrating technology into instruction their support needs change. For example, in the early stages of the ACOT project, teachers needed basic technical support as they learned to use new hardware and software. Later, when teachers began experimenting with team teaching and interdisciplinary, project-based instruction, they needed professional development related to alternative student assessment strategies (Sandholtz et al., 1997).

From their meta-analysis of 184 studies on technology use in schools, Pisapia and Perleman (1992) found that staff at several sites claimed the introduction of technology had put them into the position of being learners again. Their common struggle to master something new led to increased contact, both in terms of receiving support for technology use from fellow teachers, but also in terms of sparking discussions about what they were teaching and how technology fit into their instructional goals (Pisapia & Perleman, 1992).

Administrators must create and support interaction among their teachers with regard to technology integration. Sandholtz et al. (1997) found, in the ACOT research, that teachers who shared what they had learned with their colleagues were more successful in the integration of instructional technology. Similar findings by the Office of Technology Assessment (1995) identified providing time, for teachers to plan and learn how to integrate technology, as a factor in the effective use of technology by teachers. The ACOT research also indicated that principals in schools that have successfully integrated technology have provided time for teachers to plan together and reflect on their practices, and have given recognition for teachers' efforts (Sandholtz et al., 1997).

Encourage the Heart

Leaders encourage their followers by showing appreciation for individual excellence, celebrating accomplishments, and recognizing contributions (Kouzes & Posner, 2002). They create a spirit of community by celebrating the values and victories of the organization. According to Deal and Peterson (2000), leaders celebrate the best role models in schools. They recognize those individuals who exemplify the shared values of the organization. When teachers exemplify qualities that a school wants to reinforce, leaders must recognize these individuals publicly (Deal & Peterson, 2000).

Little (2000) maintains that leaders should provide incentives, intrinsic or otherwise, for teachers who favor collaboration over independent work and lend their support to teachers who take the lead on some shared task or problem. In similar fashion, the ACOT research indicated that principals in schools that have successfully integrated technology have provided time for teachers to plan together and reflect on their practices, and have given recognition for teachers' efforts (Sandholtz et al., 1997). NCREL (1995) recommends that administrators use a variety of methods to celebrate success; for example, (a) principals send out congratulations and notes that celebrate success, (b) teams celebrate together at the end of the year to review progress and recognize success, (c) gifts with project logos are given to successful teachers. Finally, Kouzes and Posner (2002) report that celebrating values and victories together reinforces the fact that extraordinary performance is the result of a team effort. "By celebrating people's accomplishments visibly and in group settings, leaders create and sustain team spirit; by basing celebrations on the accomplishment of key values and milestones, they sustain people's focus" (p. 389).

Technology and Leadership Summary

During the last 20 years, there has been an enormous investment in educational technology. Earlier barriers, such as lack of access or outdated equipment, have, for the most part, been removed or reduced. Nevertheless, technology is still not integrated into K-12 instruction in a pervasive manner. The review of literature proposed that transformational leadership, based on Kouzes and Posner's (1987) Five Practices for Exemplary Leadership, may provide the framework for implementing technology integration in K-12 education.

The following section contains a brief description of educational technology in North Dakota, the setting for this study. It is followed by a description of the Teaching with Technology Initiative, the project on which this study was based.

Educational Technology in North Dakota

In North Dakota, the state in which this study was conducted, educational technology is a high priority. An Education Week (Technology Counts, 2002) survey placed North Dakota first in the percent of teachers using the Internet at 87%. North Dakota ranked first among schools with Internet access from one or more classrooms at 97%. The state was third in the number of students per computer (2.8), and was fourth in students per Internet-connected computer at 4.9. All of the K-12 public schools are connected to the Internet via STAGEnet, the state's broadband network. The funding, $4.2 million, for STAGEnet was provided through state legislation in 2001, and within one year, 202 schools were connected to the network (Walz, 2002).

The North Dakota Educational Technology Council is responsible for coordinating educational technology initiatives for elementary and secondary education. The Council identified five goals and accompanying strategies for educational technology in North Dakota. The goals are:

1. Provide leadership and coordination of K-12 technology services to improve educational opportunities in North Dakota.
2. Coordinate the efficient and effective use of technology systems to enhance educational opportunities on a statewide basis.
3. Provide distance education systems to deliver a comprehensive curriculum to North Dakota students.

4. Increase professional development opportunities for North Dakota school staff to ensure students have adequate technology instruction.
5. Develop and administer security policies to sustain the stability and integrity of the educational technology systems. (Pullen, 2002, p. 21)

These goals have resulted in new educational opportunities for North Dakotans. In the fall of 2002 there were 2,376 high school students enrolled in 166 video courses. The courses were offered at 157 school sites utilizing video conferencing capabilities (Pullen, 2002). Educators have heavily utilized a statewide license for Electric Library, an online collection of resources, with 89% of the traffic coming from K-12 schools. North Dakota is one of only 12 states to have a "virtual high school", the North Dakota Division of Independent Study. In addition to North Dakota students, the Division offers distance education courses to students in 49 other states and 38 foreign countries. EduTech, an educational technology service provider, is funded by the state to provide technology resources and professional development for K-12 administrators, teachers, and technology coordinators in North Dakota. Additionally, there are several other state-funded technology initiatives and projects being implemented.

In addition to state funded projects, North Dakota is the recipient of two important educational technology grants. First, the Technology Academy for School Leaders, a Bill & Melinda Gates Foundation Grant, provides professional development for school administrators in technology knowledge, skills, and assessment (Pullen, 2002). Second, the North Dakota Teaching with Technology Initiative is a $7.5 million federally funded grant that provides professional development to K-12 educators in the state. The Initiative focuses on technology integration competencies for both teachers and school administrators. The data derived from this initiative was used in this study.

It is clear in North Dakota's 2002 Statewide Information Technology Plan that education plays an important role now, and in the future. The plan articulates:

> Technology drives much of the change we see today, creating new challenges as well as exciting possibilities. The application of technology to excellence in education is especially critical. Education acts as a catalyst, developing the workforce necessary to lead the transition to a new economy. Technology links people and businesses, schools and government, in ways never before possible, creating vital new opportunities for all North Dakota citizens. (Walz, 2002, p. 1)

Based on the aforementioned illustrations, it is apparent that educational technology is important to both policy makers and educators in the state of North Dakota.

Teaching with Technology Project Overview

The basis for this study was the North Dakota Teaching with Technology Initiative (ND TWTi). This initiative was funded in 1998 through the U. S. Department of Education's Technology Innovation Challenge Grant program. The ND TWTi is a statewide program within North Dakota. ND TWTi began in 1999 and its mission is to provide training and support to all educators in both public and private K-12 schools (Technology Innovation Challenge Grant Program

Performance Report, 2001). Since that time, the initiative has been implemented through a statewide eight-region structure. The primary goal of the ND TWTi is to provide professional development experiences and onsite assistance that will enable educational staff to effectively integrate technology as an instructional tool into the K-12 curriculum (Technology Innovation Challenge Grant Program Performance Report, 2001).

The ND TWTi structure is based on a framework developed by the Milken Exchange on Education Technology (Technology Innovation Challenge Grant Program Performance Report, 2001). "The framework is a set of indicators for policymakers to consider when assessing whether or not schools have established the 'essential conditions' necessary to begin improving students learning through technology" (Lemke & Coughlin, 1998, p. 2). The framework includes seven interdependent components know as the Seven Dimensions. The Seven Dimensions include: (1) Learners, (2) Learning Environments, (3) Professional Competency, (4) System Capacity, (5) Community Connections, (6) Technology Capacity, and (7) Accountability (Lemke & Coughlin, 1998, p. 2). The Milken Exchange intends that the educational community, technology coordinators, policymakers, and researchers use the framework as:

- A vision that will define expectations for the public investments in K-12 learning technology;
- A self-assessment tool that assists schools, districts, and states to gauge their own progress toward that vision;

- A planning tool for strategizing how to bring technology and telecommunications into their systems in ways which improve student learning;
- An accountability system for tracking the return on public investments in education technology; and,
- A research agenda that will help guide studies of how and under what conditions technology is an effective tool for learning (Lemke & Coughlin, 1998, p. 3).

The ND TWTi is based on the Seven Dimensions framework and many of the essential conditions from the framework are incorporated into the ND TWTi goals (Technology Innovation Challenge Grant Program Performance Report, 2001). The initiative is comprised of three separate and sequential phases of professional development. Instructional activities and materials are customized for each of the three phases. The content and outcomes are based on National Council for the Accreditation of Teacher Education (NCATE) and International Society for Technology in Education (ISTE, 2000) standards. In addition, each phase of professional development consists of two strands: the Educator Strand for teachers and the Leadership Strand for administrators (Technology Innovation Challenge Grant Program Performance Report, 2001).

Phase I

The first phase of professional development, Phase I, was completed in May of 2001 with participation by 8,546 teachers and 574 administrators from 423 school buildings throughout North Dakota (Keller, 2001). That means that

89% of all certified, full- and part-time public and private North Dakota educators completed Phase I. During Phase I, participants in the Educator Strand had the opportunity to redesign a lesson or unit to better integrate technology as a tool for teaching and learning (Technology Innovation Challenge Grant Program Performance Report, 2001). The educators were then required to implement the new lesson or unit into their classroom and reflect on their experiences. The resulting product was a portfolio documenting what they changed and how it worked (Technology Innovation Challenge Grant Program Performance Report, 2001).

The Leadership Strand in Phase I was developed by the ND TWTi project directors, and was based on proven models developed by the North Central Regional Educational Laboratory (NCREL), The North Central Regional Technology in Education Consortium (NCRTEC), and the Milken Exchange on Educational Technology. The Leadership Strand provided administrators with professional development in five areas: assessing and planning, organizing a support system, encouraging and supporting staff, leading and managing change, and designing professional development (Technology Innovation Challenge Grant Program Performance Report, 2001). Administrators worked on developing their technology skills, increasing their knowledge base regarding leadership for technology integration, and on modeling the effective use of technology. Most importantly, administrators supported educators in their buildings as part of the ND TWTi process (Technology Innovation Challenge Grant Program Performance Report, 2001).

Phase II

Phase II of ND TWTi was completed in January of 2003. It was implemented in schools over three separate semesters. In Phase II, 5,671 teachers and 394 administrators participated (Keller, 2001). In keeping with Phase I, Phase II of ND TWTi also had two strands: an Educator Strand and a Leadership Strand (Technology Innovation Challenge Grant Program Performance Report, 2001). In the Educator Strand, teachers used three teaching and learning strategies to promote higher order thinking and engage students: project-based learning, problem-based learning, and inquiry-based learning (Technology Innovation Challenge Grant Program Performance Report, 2001). The appropriate use of these strategies allowed students to work on authentic tasks and challenging problems, often connecting with peers, community members, and experts in the field (Technology Innovation Challenge Grant Program Performance Report, 2001). Correspondingly, technology becomes a critical tool to support the implementation of these strategies. The participating educators used an on-line course where they were guided through a Phase II proposal development process (Keller, 2001). The proposal indicated the teaching strategy that the educator would employ over the course of the semester (Keller, 2001). Areas of the curriculum in which technology-supported activities are critical were identified and the new student learning activities the educator planned to implement were discussed with their mentor and regional ND TWTi support personnel (Keller, 2001). The proposal included information on curriculum standards, classroom management, and assessment techniques (Keller, 2001).

The Phase II Leadership Strand involved at least one administrator and one mentor per participating building (Technology Innovation Challenge Grant Program Performance Report, 2001). The role of the Leadership Strand participants was to work to implement significant change initiatives that supported classroom teachers in four areas:

1. Development of proficiencies in the use of technology tools;
2. The implementation of new strategies for teaching and learning (including project-based, problem-based, and inquiry-based learning);
3. Organizational and management strategies to support learning in technology-rich environments;
4. The use of technology for new collaborative professional practices. (Technology Innovation Challenge Grant Program Performance Report, 2001)

The administrators and mentors led participating educators through a process aimed at supporting standards-based instruction. The Leadership Strand participants coached, guided, and supported educators as they worked through the Educator strand (Keller, 2001).

Phase III

The final phase of ND TWTi, Phase III, began in January 2003. It is a self-directed experience requiring high levels of collaboration (Technology Innovation

Challenge Grant Program Performance Report, 2001). The educator curriculum is entirely on-line with access to support from building-based leadership that has been cultivated in Phase I and II. In Phase III, students will be explorers, teachers, and managers of their own learning (Technology Innovation Challenge Grant Program Performance Report, 2001). Teachers will be facilitators, guides, and co-learners. Learning activities are intended to be authentic, challenging, and multidisciplinary (Technology Innovation Challenge Grant Program Performance Report, 2001).

The ND TWTi Phase III Leadership Strand is designed for district/building administrators and key K-12 educators to serve as leadership team members in the participating North Dakota schools (Technology Innovation Challenge Grant Program Performance Report, 2001). Participants investigate leadership concepts and practices. The leadership strand participants design and implement a building-wide professional development plan. The leaders then coach and support the classroom educators as they work toward their individual professional development goals. The professional development planning process uses data from the project and other sources for goal identification. The leadership team is also responsible for planning and performing formative and summative evaluation activities (Technology Innovation Challenge Grant Program Performance Report, 2001).

Teaching with Technology Initiative Summary

The ND TWTi was funded in 1998 through the U. S. Department of Education's Technology Innovation Challenge Grant program. The initiative is a statewide program within North Dakota. ND TWTi began in 1999 and its mission is to provide training and support to all educators in both public and private K-12 schools. The initiative is based on the Milken Exchange on Educational Technology's Seven Dimensions framework and is comprised of three separate and sequential phases of professional development for administrators and teachers (Technology Innovation Challenge Grant Program Performance Report, 2001). Data from the initiative was used in this study.

Chapter II presented a brief history of technology with regard to education, technology integration, student achievement, and the change in teaching practices required by technology integration. Transformation leadership, the theoretical base for the study, was presented, followed by its application to the integration of educational technology. Lastly, the chapter included an overview of the ND TWTi, the project on which this study was based. Chapter III presents a description of the methodology used to conduct this study including the purpose, the population studied, the instruments used, the data collection, and the methods of data analysis.

CHAPTER III

METHODOLOGY

Initially, this chapter presents the purpose of the study, the research questions, and the population of the study. Further, this chapter will explain the methods and instrumentation used to conduct this study as well as the facts and figures leading to the analysis of the results.

The Purpose of the Study

The purpose of this study was to examine relationships that may reflect the influence school administrators have on teachers' technology skills and technology integration. The study was rooted in the theoretical constructs of both change theory in education (Fullan, 1991; Fullan, 1999) and transformational leadership theory (Burns, 1978, Kouzes & Pozner, 1987). The study used transformational leadership theory to examine the leadership by school administrators and the technology integration competencies of K-12 teachers in North Dakota.

Data obtained from a U.S. Department of Education Technology Literacy Challenge Project was used in this study. The research questions focused specifically on three of the five practices of Kouzes & Posner's (1987) contribution to transformational leadership theory: *a) Model the Way, b) Inspire a Shared Vision, c) Challenge the Process, d) Enable Others to Act, and e)*

Encourage the Heart. A relationship between Kouzes and Posner's (1987) two practices, *Inspire a Shared Vision* and *Encourage the Heart*, could not be measured with the data captured for this study. Therefore, the investigator did not include those practices as part of the research questions.

1. Is there a relationship between ratings of school administrators with regard to modeling effective use of technology and the technology integration competencies of teachers under their leadership? *a) Model the Way – Leaders create standards of excellence and then set an example for others to follow. By acting as role models, leaders inspire followers to put the good of the whole organization above self-interest* (Kouzes & Posner, 1987).

2. Is there a relationship between ratings of school administrators with regard to leading professional development and the technology integration competencies of teachers under their leadership? *d) Enable Others to Act – Leaders foster collaboration and build spirited teams. They actively involve others. Leaders create an atmosphere of trust. They make each person feel capable and powerful* (Kouzes & Posner, 1987).

3. Is there a relationship between the ratings of school administrators with regard to leading and managing systemic change and the technology integration competencies of teachers under their leadership? *c) Challenge the Process – Leaders search for opportunities to change the status quo. They look for innovative ways to improve the organization. They take risks* (Kouzes & Posner, 1987).

4. Is there a relationship between ratings of school administrators with regard to maintaining a knowledge base and the technology integration competencies of teachers under their leadership? *c) Challenge the Process – Leaders search for opportunities to change the status quo. They look for innovative ways to improve the organization. They take risks* (Kouzes & Posner, 1987).

Population

The sample for this study consisted of the K-12 teachers and administrators who participated in the North Dakota Teaching with Technology Initiative (ND TWTi) in Phases I and II. Phase I participants included 8,546 teachers and 574 administrators from 423 public and private school buildings throughout North Dakota (Keller, 2001). These numbers account for 89% of the K-12 educators in North Dakota. In Phase II, 5,671 teachers and 394 administrators participated in the project accounting for 59% of North Dakota's K-12 educators (Keller, 2001).

Instruments

Professional Competency Continuum

The main data collection tool for this study was the *Professional Competency Continuum* (PCC) profile assessment. The PCC was developed through a partnership between the Milken Exchange on Educational Technology and the North Central Regional Educational Laboratory (NCREL) and was based on research and expert panel input (Coughlin & Lemke, 1999). The PCC is part of the Professional Competency dimension in the Seven Dimensions framework from the Milken Exchange on Educational Technology. The PCC measures the classroom behavior of educators, both administrators and teachers, in relation to national technology integration standards. The Continuum is based on the "stages of instructional evolution" identified in the research from the Apple Classrooms of Tomorrow program (Coughlin & Lemke, 1999).

The stages used by the Continuum are Entry, Adaptation, and Transformation. According to Coughlin & Lemke (1999), at the Entry stage educators, students, and the community are aware of the possibilities that technology holds for improving learning, but learning and teaching remain relatively unchanged. Educators at this level lack access to technology and the skills to implement and sustain significant changes in their teaching. At stage two, Adaptation, technology is integrated into the classroom in support of existing practice. Educators at this stage have developed skills related to the use of technology, but have primarily applied these skills to automate, accelerate, and enhance the teaching and learning strategies already in place (Coughlin & Lemke, 1999). At Transformation, stage three, technology is a catalyst for significant changes in learning practice. Students and teachers adopt new roles and relationships. New learning opportunities are possible through the application of technology to the entire school community (Coughlin & Lemke, 1999).

Participants entering each phase of the ND TWTi project were first asked to take the PCC assessment. The PCC is a self-reporting tool, which means that educators taking the assessment are rating themselves against pre-defined criteria. A Likert-type scale ranging from one (lowest) to 10 (highest) is used to answer each question. In answering each question, respondents were asked to identify behaviors that best illustrate their own performance behaviors. Upon completion of the instrument, educators were placed on the continuum ranging from entry to adaptation to transformation. An educator's placement on the continuum corresponds to the degree to which the educator exhibits transformational behaviors with regard to technology integration (Technology Innovation Challenge Grant Program Performance Report, 2001).

ND TWTi used two versions of the PCC. One was aimed at teachers and the other at administrators. The teacher survey instrument is grouped into four major themes, or competencies, that describe educator behavior. These competencies include Core Technology Skills; Curriculum, Learning, and Assessment; Professional Practice; and Classroom and Instructional Management (Coughlin & Lemke, 1999). The competencies are the essential conditions necessary to implement the vision for educational technology. The PCC was developed to determine if the teacher has the requisite skills to implement the vision. Coughlin states,

> For those aspects of the vision that require new teaching and learning practices, we ask about the skill that the teacher may have in implementing those practices. For those aspects of the vision that relate to new modes of professional growth and interaction, we ask if the teacher has the requisite skills to participate, even initiate these new interactions (personal communication, March 4, 2003).

The teacher survey instrument has 65 questions that are tied to 22 technology indicators (Technology Innovation Challenge Grant Program Performance Report, 2001). Each of the indicators is aligned to one of the four competency areas. For each competency area, the PCC reports a competency score. The competency score is the mean calculated from the scores marked by the respondent as they answer each question. Upon completion of the PCC, the respondent receives a report with mean scores from each competency area as well as an overall mean score that is calculated from the means of the four competency areas (Technology Innovation Challenge Grant Program Performance Report, 2001).

Figure 2 illustrates the relationship between questions, indicators, and competencies on the teacher survey instrument from the PCC.

PCC Competencies	Indicators used to Derive PCC Competencies	No. of Questions per Indicator
Core Technology Skills	• Hardware/Computer	8
	• Hardware/Other	1
	• Applications	6
	• Information Tools	5
	• Network Tools	1
	• Multimedia/Presentation Tools	4
Curriculum, Learning, and Assessment	• Curriculum Design	3
	• Teaching/Learning Strategies	3
	• New Roles for Educators	3
	• New Roles for Students	5
	• Assessment	4
Professional Practice	• Uses of Technology for Personal Productivity	2
	• Professional Collaboration	2
	• Communication to/with Stakeholders	3
	• Professional Growth	2
	• Community Outreach	2
	• Ethical Use	2
	• Professional Resources	1
	• Resource Acquisition	1
Classroom and Instructional Management	• Organization and Use	1
	• Access and Location	3
	• Instructional Management	3

Figure 2. Technology Indicators and Number of Questions per Indicator Grouped by Teacher Behavior Competencies from the Professional Competency Continuum

The administrator survey instrument has 64 questions that are tied to 18 technology indicators (Lemke & Coughlin, 1999). The technology indicators are grouped into three competency areas that describe administrator behavior. These competencies include Core Technology Skills, Professional Practice, and Administrative Competency (see Figure 3).

Administrator PCC Competencies	Indicators used to Derive PCC Competencies	No. of Questions per Indicator
Core Technology Skills	• Hardware/Computer • Hardware/Other • Applications • Information Tools • Network Tools • Multimedia/Presentation Tools	8 1 6 5 1 4
Professional Practice	• Uses of Technology for Personal Productivity • Professional Collaboration • Communication to/with Stakeholders • Professional Growth • Community Outreach • Ethical Use • Professional Resources • Resource Acquisition	2 2 3 2 2 2 1 1
Administrative Competency	• Modeling Effective Use • Leading Professional Development • Leading and Managing Systemic Change • Maintaining a Knowledge Base	7 8 4 5

Figure 3. Technology Indicators and Number of Questions per Indicator Grouped by Administrator Behavior Competencies from the Professional Competency Continuum

At the request of the investigator, a panel of experts aligned the indicators from the PCC Administrator Survey tool with Kouzes and Posner's (1987, 2002) Five Exemplary Leadership Practices. The expert panel included the co-directors of the ND TWTi project and two of the ND TWTi regional technologists. Based on the panel's recommendation, only the indicators from the Administrative Competency area were utilized. The Administrative Competency area contains four indicators: (a) Modeling Effective Use; (b) Leading Professional Development; (c) Leading and Managing Systemic Change; and (d) Maintaining a Knowledge Base. The panel aligned Kouzes and Posner's (1987) *Model the Way* with the PCC's Modeling Effective Use. Kouzes and Posner's (1987) *Enable Others to Act* was aligned with the PCC's Leading Professional Development and Kouzes and Posner's (1987) *Challenge the Process* was aligned with the PCC's Maintaining a Knowledge Base and Leading and Managing Systemic Change (see Table 1).

Ed Coughlin (2003), the co-developer of the Seven Dimensions, stated that, "One of the things we learned in implementing the Seven Dimensions is that vision is the key. People need to have pictures in their head of what powerful practice looks like. That vision is measured in Dimension Four, System Capacity" (personal communication, March 4, 2003). Based on Coughlin's assertion that vision was not measure by the PCC, Kouzes and Posner's (1987) practice of *Inspire a Shared Vision* was not considered in this study. Similarly, the fifth leadership practice, *Encourage the Heart*, could not be measured by the PCC, and therefore, was not considered.

Table 1 illustrates the alignment between the PCC administrative competency indicators with Kouzes and Posner's (1987, 2002) leadership practices.

Table 1. Kouzes and Posner's Leadership Practices Aligned with Administrative Competency Indicators from the Professional Competency Continuum

Kouzes & Posner's Leadership Practices	Administrative Competency Indicators	Number of Questions per Indicator
Model the Way	Modeling Effective Use	7
Enable Others to Act	Leading Professional Development	8
Challenge the Process	Leading and Managing Systemic Change	4
	Maintaining a Knowledge Base	5

Validation

A major component of the ND TWTi was the availability of instructional and technical support provided by eight Regional Educational Technologists (RETs). The RETs possessed both education and experience in educational technology integration at the K-12 level. One RET was located in each of the eight geographical regions of North Dakota. The RETs worked directly with the administrators in each school to implement each phase of the ND TWTi. This arrangement allowed the RETs to observe the administrative and technological skills and practices of the school administrators. Because the PCC is a self-reporting survey, the ND TWTi directors designed a second tool to provide validity data that contained components from the Administrator PCC survey.

Based on field observations, the (RETs) rated the administrative and technology competencies of school administrators.

The data from both tools were analyzed to find relationships. Results indicated there is a significant positive relationship between the self-reported ratings of administrators on the PCC and the RET's ratings of administrators. The Pearson correlation for core technology skills was .64**, professional practice was .39**, and administrative competencies was 35* (** indicates significance <.001, * indicates significance at the .05 level). The data indicate that administrators' ratings on the PCC were similar to the ratings given them by the RETs.

Data Collection Procedures

The ND TWTi Management Team holds the data from the PCC instruments. Bismarck Public Schools is the local educational agency (LEA) and the fiscal agent for the ND TWTi project and is a member on the management team. The investigator is an employee of Bismarck Public Schools and a member of the management team. The investigator obtained permission from the management team to use the ND TWTi data. Arrangements were made with the ND TWTi director to obtain the data following verification that the investigator was to use the data for research purposes (see Appendix A). The data was downloaded electronically from the NCRTEC server and analyzed using Microsoft Access, Microsoft Excel, and SPSS computer software.

Statistical Treatment of the Data

This study was analyzed in two parts. Part I was an analysis of the data for mean values, standard deviations, and significant differences in the technology competency ratings of administrators and teachers, respectively. The data was analyzed for administrators and teachers who participated in both Phase I and Phase II of the ND TWTi. Means and standard deviations provided descriptive data from the sample population. To determine if there were differences in technology competency ratings of administrators and teachers, respectively, from Phase I to Phase II, a *t* test for paired samples was used.

Part II was an analysis of the data for relationships between the administrative competency ratings of administrators and the technology competency ratings of teachers. Research questions one through four were tested for relationships using the Pearson Product-Moment correlation. Relationships between each indicator from the administrative competency area and the technology integration competencies of teachers were tested for significance at the .05 level.

Summary

The data used for this study were obtained from the ND TWTi. The PCC was the instrument used by the initiative to obtain the administrative competency ratings of administrators and the technology integration competency ratings of teachers. Correlations were used to measure the relationship between administrative competency ratings and technology integration competency ratings. Data were compiled and analyzed using computer software entitled

Microsoft Access, Microsoft Excel, and Statistical Package for the Social Sciences (SPSS). The results of the analyses will be presented and discussed in the next chapter.

CHAPTER IV

ANALYSIS OF THE DATA

The data from this study were used to determine the impact of staff development provided by the ND TWTi on teachers' and administrators' technology integration competency ratings; the relationship between modeling effective use of technology by administrators and teachers' technology integration competencies; the relationship between administrators' leading professional development and teachers' technology integration competencies; the relationship between the administrators' ratings on leading and managing systemic change and teachers' technology integration competencies; and the relationship between maintaining a knowledge base by administrators and the technology integration competency ratings of teachers. This chapter contains a general analysis of the data using descriptive and inferential statistics to measure the relationships as they relate to each research question. Statistical analysis was carried out under the advisement of Professor Richard Landry of the University of North Dakota. The computer programs, Microsoft Excel, Microsoft Access, and Statistical Package for Social Sciences (SPSS v 11.0.1), were used to assist in the statistical analysis of the data.

Report of the Data

Sample Characteristics

The sample for the study consisted of the K-12 teachers and administrators who participated in the North Dakota Teaching with Technology Initiative (ND TWTi). Phase I participants included 8,546 teachers of whom 5,681 (77%) were female and 1,749 (23%) were male; in addition, there were 574 administrators, with 168 (37.3%) females and 282 (62.7%) males. Phase II included 5,671 teachers, with 4,307 (77%) females and 1,285 (23%) males. The 394 administrators in Phase II included 118 (34.1%) females and 228 (65.9%) males. (Note: Some of the participants did not report their gender or level of education.) The majority, 5,661 (70%), of the teachers participating in ND TWTi had Bachelors degrees, and 2,316 (29%) had Masters degrees or higher. The number of administrators with Bachelors, Masters, and Doctoral degrees was 162 (32%), 294 (58%), and 15 (3%), respectively. The number of participants from elementary schools was 4,567 (52%), from middle schools was 1,324 (16%), and from high schools was 2,665 (32%). A complete table of the demographic characteristics of the teachers and administrators who participated in ND TWTi is included in Appendix B of this study.

Statistics of Samples Studied

Initially, the data were analyzed to determine the influence of the ND TWTi on administrators' technology integration competencies from Phase I to Phase II. The test statistic selected to determine if there was influence was the *t* test for paired samples. Table 2 presents the mean values, standard deviations, *t* values, and probabilities for the technology competency ratings of administrators who participated in Phase I and Phase II of the ND TWTi. The data are presented for each technology competency area in the order in which they were presented in the assessment (see Table 2). The expectation was that participants would score higher on Phase II than they did on Phase I.

Table 2. Means, Standard Deviations, *t* values, and Probabilities for Differences of Administrative Competencies by Administrators on Phase I and Phase II of the ND TWTi (N = 333, two-tailed)

Administrator	Phase I		Phase II			
Administrative Competencies	Mean	SD	Mean	SD	*t* value	*P*
Modeling Effective Use	5.01	1.42	6.40	1.39	21.70	<.001
Leading Professional Development	4.27	1.52	5.94	1.85	20.40	<.001
Leading & Managing Systemic Change	5.03	1.76	7.43	1.65	26.38	<.001
Maintaining a Knowledge Base	4.67	1.59	6.37	1.56	21.97	<.001

Administrators rated their technology integration competencies on a ten-point scale, with 10 being high. The highest mean rating in Phase I was 5.03 and the lowest mean rating was 4.27. In Phase II, following professional development in technology integration, the highest mean rating was 6.40 and the lowest mean rating was 5.94. In each of the competencies, the data indicate that administrators rated themselves higher in Phase II than in Phase I. The greatest increase (2.4) came in the competency area: Leading and Managing Systemic Change. The smallest increase (1.39) came in the competency area: Modeling Effective Use. The differences between the scores from Phase I to Phase II are significant beyond the .001 level, indicating that the ND TWTi did, indeed, influence the ratings of administrators in administrative competency.

Subsequently, the data were analyzed to determine the influence of the ND TWTi on teachers' technology integration competencies from Phase I to Phase II. The test statistic selected to determine if there was influence was the *t* test for paired samples. Table 3 presents the mean values, standard deviations, *t* values, and probabilities for the technology competency ratings of teachers who participated in Phase I and Phase II of the ND TWTi. Data are presented in the order each technology competency area was assessed in ND TWTi. The expectation was that teachers would score higher on Phase II than they did on Phase I.

Table 3. Means, Standard Deviations, *t* values, and Probabilities for Differences of Technology Integration Competency Ratings by Teachers in Phase I and Phase II of the ND TWTi (N = 5,062, two-tailed)

Teacher	Phase I		Phase II			
Technology Integration Competencies	Mean	SD	Mean	SD	*t* value	*p*
Core Technology Skills	4.05	1.79	5.26	1.76	72.32	<.001
Curriculum, Learning, & Assessment	3.83	1.58	4.96	1.69	60.97	<.001
Classroom & Instructional Management	4.13	1.70	5.38	1.74	62.84	<.001
Professional Practice	3.98	1.64	5.29	1.67	70.58	<.001
Overall Score	3.98	1.57	5.20	1.60	78.540	<.001

For teachers, the highest mean rating in Phase I was 4.13 and the lowest mean rating was 3.83. In Phase II, following professional development in technology integration, the highest mean rating was 5.38 and the lowest mean rating was 4.96. Combining the ratings from the individual competency areas and computing the mean obtained an overall score for the assessment. The mean of the overall scores by teachers in Phase I was 3.98 and increased to 5.20 in Phase II.

In each of the competencies, the data indicate that teachers rated themselves higher in Phase II than in Phase I. The greatest increase (1.31) came in the competency area: Professional Practice. The smallest increase (1.13) came in the competency area: Curriculum, Learning, and Assessment. The differences between the scores from Phase I to Phase II are significant beyond the .001 level, indicating that the ND TWTi did, indeed, influence the ratings of teachers in technology integration competencies.

The data from the two previous tables showed increases from Phase I to Phase II in all competency areas. All differences were significant beyond the .001 level indicating that the ND TWTi program had a significant influence on the technology integration competency ratings of both administrators and teachers.

Research Questions

Questions one, two, three, and four were tested using the Pearson Product Moment correlation coefficient. Analyses were carried out for each indicator for administrative competency and technology integration competency to describe findings and to determine correlations. The level of significance for all inferential tests was set at .05. The number of buildings studied ranges from 299 to 381 in Phase I and from 295 to 296 in Phase II. The variability in the number of buildings studied resulted because some administrators did not complete all competency areas on the PCC. If the administrator did not complete a competency area, the competency scores for that building were removed from statistical analyses. The following data were organized and introduced in the order of the research questions listed in Chapter I.

Question 1. Is there a relationship between ratings of school administrators with regard to modeling effective use of technology and the technology integration competencies of teachers under their leadership? Table 4 presents the Pearson correlation coefficients for the ratings of school administrators with regard to modeling effective use of technology and the technology integration competency ratings of teachers. The table presents data for both Phase I and Phase II of ND TWTi. The data were grouped by school building, thus administrator ratings were correlated with teacher ratings from the same school. The grouping resulted in a population of administrators and teachers from 381 schools in Phase I and 296 schools in Phase II.

The data in Table 4 indicate the ratings of school administrators with regard to modeling effective use of technology in Phase I exhibited a positive correlation to all five teacher technology integration competency ratings in Phase I. All five correlations were significant beyond the .001 level.

In the second phase of the project, Phase II, the data indicate there were positive correlations between ratings of school administrators with regard to modeling effective use of technology and the technology integration competency ratings of teachers. The correlations computed from the Phase II data were weaker, however, than that of Phase I. The data were grouped by school building; therefore, the administrator had oversight of the teachers from that building in both phases of the study. The relationships indicate that teachers who rated themselves high in technology integration competencies worked in school buildings in which administrators rated themselves high in modeling technology use.

Table 4. Pearson *r* Correlation Coefficients between Ratings for Modeling Effective Use of Technology by Administrators and Teacher Technology Integration Competency Ratings (N = 381 in Phase I, N = 296 in Phase II, two-tailed)

		Teacher Ratings on Technology Integration Competencies				
Phase I		Core Technology Skills	Curriculum, Learning, & Assessment	Classroom & Instructional Management	Professional Practice	Overall Score
Administrative Competency: Modeling Effective Use	Pearson Correlation	.292**	.223**	.249**	.296**	.285**
	Significance	.000	.000	.000	.000	.000
	Mean	4.05	3.83	4.13	3.98	3.98
Mean = 5.01 SD = 1.42	Standard Deviation	1.79	1.58	1.70	1.64	1.57

		Teacher Ratings on Technology Integration Competencies				
Phase II		Core Technology Skills	Curriculum, Learning, & Assessment	Classroom & Instructional Management	Professional Practice	Overall Score
Administrative Competency: Modeling Effective Use	Pearson Correlation	.202**	.149*	.141*	.241**	.212**
	Significance	.000	.010	.015	.000	.000
	Mean	5.26	4.96	5.38	5.29	5.20
Mean = 6.40 SD = 1.49	Standard Deviation	1.76	1.69	1.74	1.67	1.60

** significant < 0.001 level (2-tailed) * significant at the 0.05 level (2-tailed)

In Phase I and Phase II, the correlations were strongest, .296** and .241** respectively, between administrators' modeling technology use and that of teachers' professional practices ratings. In Phase I, the relationship was weakest, .223**, in the area of curriculum, learning, and assessment; but in Phase II, the relationship was weakest, .141*, in the area of classroom and instructional management.

Question 2. Is there a relationship between ratings of school administrators with regard to leading professional development and the technology integration competencies of teachers under their leadership? Table 5 presents the Pearson correlation coefficients for ratings of school administrators with regard to leading professional development and the technology integration competency ratings of teachers. The table presents data for both Phase I and Phase II of ND TWTi. The data were grouped by school building, thus administrator ratings were correlated with teacher ratings from the same school. The grouping resulted in a population of administrators and teachers from 381 schools from Phase I and 295 schools in Phase II.

The data in Table 5 indicate the ratings of school administrators with regard to leading professional development in Phase I exhibited a positive correlation to all five teacher technology integration competency ratings in Phase I. All correlations were significant beyond the .001 level.

Table 5. Pearson *r* Correlation Coefficient between Ratings of Administrators with Regard to Leading Professional Development and Teacher Technology Integration Competency Ratings (N = 381 in Phase I, N = 295 in Phase II, two-tailed)

		Teacher Ratings on Technology Integration Competencies				
Phase I		Core Technology Skills	Curriculum, Learning, & Assessment	Classroom & Instructional Management	Professional Practice	Overall Score
Administrative Competency: Leading Professional Development	Pearson Correlation	.216**	.188**	.212**	.224**	.219**
	Significance	.000	.000	.000	.000	.000
	Mean	4.05	3.83	4.13	3.98	3.98
Mean = 4.27 SD = 1.52	Standard Deviation	1.79	1.58	1.70	1.64	1.57

		Teacher Ratings on Technology Integration Competencies				
Phase II		Core Technology Skills	Curriculum, Learning, & Assessment	Classroom & Instructional Management	Professional Practice	Overall Score
Administrative Competency: Leading Professional Development	Pearson Correlation	.202**	.133*	.117*	.212**	.198**
	Significance	.000	.022	.045	.000	.001
	Mean	5.26	4.96	5.38	5.29	5.20
Mean = 5.94 SD = 1.85	Standard Deviation	1.76	1.69	1.74	1.67	1.60

** significant < 0.001 level (2-tailed) * significant at the 0.05 level (2-tailed)

In the second phase of the project, Phase II, the data indicate there were positive correlations between ratings of school administrators with regard to leading professional development and the technology integration competency ratings of teachers. The correlations computed in Phase I were stronger than those computed for Phase II. The relationship indicates that teachers who rated themselves high in technology integration competencies worked in school buildings in which administrators rated themselves high in leading professional development. In Phase I and Phase II, the correlations were strongest, .224** and .212** respectively, between administrators' leading professional development and teachers' professional practices ratings. Similar to findings in the previous question, the weakest relationship, .188**, in Phase I occurred with curriculum, learning, and assessment. In Phase II, the weakest relationship, .117*, was found with classroom and instructional management.

Question 3. Is there a relationship between the ratings of school administrators with regard to leading and managing systemic change and the technology integration competencies of teachers under their leadership? Table 6 presents the Pearson correlation coefficients for the leading and managing systemic change ratings of administrators and the technology integration competency ratings of teachers. The table presents data for both Phase I and Phase II of ND TWTi. The data were grouped by school building, thus administrator ratings were correlated with teacher ratings from the same school. The grouping resulted in a population of administrators and teachers from 299 schools in Phase I and 295 schools in Phase II.

The data in Table 6 indicate the ratings of school administrators with regard to leading and managing systemic change and the technology integration competencies of teachers in Phase I exhibited a positive correlation to all five teacher technology integration competency ratings in Phase I. All correlations in Phase I were significant at the .05 level or beyond.

Table 6. Pearson *r* Correlation Coefficient between Ratings of Administrators with regard to Leading and Managing Systemic Change and Teacher Technology Integration Competency Ratings (N = 299 in Phase I, N = 295 in Phase II, two-tailed)

		Teacher Ratings on Technology Integration Competencies				
Phase I		Core Technology Skills	Curriculum, Learning, & Assessment	Classroom & Instructional Management	Professional Practice	Overall Score
Administrative Competency: Leading and Managing Systemic Change	Pearson Correlation	.192**	.121*	.166**	.177**	.171**
	Significance	.001	.037	.004	.002	.003
	Mean	4.05	3.83	4.13	3.98	3.98
Mean = 5.03 SD = 1.76	Standard Deviation	1.79	1.58	1.70	1.64	1.57

		Teacher Ratings on Technology Integration Competencies				
Phase II		Core Technology Skills	Curriculum, Learning, & Assessment	Classroom & Instructional Management	Professional Practice	Overall Score
Administrative Competency: Leading and Managing Systemic Change	Pearson Correlation	.156**	.095	.104	.220**	.164**
	Significance	.007	.102	.074	.000	.005
	Mean	5.26	4.96	5.38	5.29	5.20
Mean = 7.43 SD = 1.65	Standard Deviation	1.76	1.69	1.74	1.67	1.60

** significant < 0.001 level (2-tailed) * significant at the 0.05 level (2-tailed)

In Phase II, the data indicate there were positive correlations between ratings of school administrators with regard to leading and managing systemic change and three of the technology integration competency ratings of teachers: (a) core technology skills .156**; (b) professional practice, .220**; and (c) the overall score, .164**. The remaining two correlations, (c) curriculum, learning, and assessment, and (d) classroom and instructional management, were not significant indicating there were no relationships between them and the administrators with regard to leading and managing systemic change. To keep the reader from being misled, professional practice refers to the activities the teacher does to maintain their own professional abilities. The teacher uses technology to collaborate with colleagues, to communicate with peers, outside experts, and parents. Professional practice enhances the work the teacher does in the classroom.

Interestingly, the correlation between administrators' leading and managing systemic change and teachers' professional practice, in Phase II, was higher than that for Phase I. This differs from the results in the previous research questions in which Phase I correlations were stronger than Phase II.

The relationships indicate that teachers who rated themselves high in technology integration competencies worked in school buildings in which administrators rated themselves high in leading and managing systemic change. It should be noted that the correlation between administrators' leading and managing systemic change and teachers' core technology skills was strongest, .192**, in Phase I. In Phase II, however, the strongest correlation, .220**, occurred between administrators' leading and managing systemic change and teachers' professional practice. As in the previous questions, the weakest correlation, .121*, was in curriculum, learning, and assessment in Phase I.

Question 4. Is there a relationship between ratings of school administrators with regard to maintaining a knowledge base and the technology integration competencies of teachers under their leadership? Table 7 presents the Pearson correlation coefficients for the ratings of school administrators with regard to maintaining a knowledge base and the technology integration competency ratings of teachers. The table presents data for both Phase I and Phase II of ND TWTi. The data were grouped by school building, thus administrator ratings were correlated with teacher ratings from the same school. The grouping resulted in a population of administrators and teachers from 380 schools in Phase I and 295 schools in Phase II.

The data in Table 7 indicate the ratings of school administrators with regard to maintaining a knowledge base in Phase I exhibited a positive correlation to all five teacher technology integration competency ratings in Phase I. All five of the correlations were significant beyond the .001 level in Phase I.

In Phase II, the data indicate there were positive correlations between ratings of school administrators with regard to maintaining a knowledge base and the technology integration competency ratings of teachers. The correlations computed in Phase I are higher than those computed for Phase II. The relationships indicate that teachers who rated themselves high in technology integration competencies worked in school buildings in which administrators rated themselves high in maintaining a knowledge base.

Table 7. Pearson *r* Correlation Coefficient between Ratings of Administrators with regard to Maintaining a Knowledge Base and Teacher Technology Integration Competency Ratings (N = 380 in Phase I, N = 295 in Phase II, two-tailed)

		Teacher Ratings on Technology Integration Competencies				
Phase I		Core Technology Skills	Curriculum, Learning, & Assessment	Classroom & Instructional Management	Professional Practice	Overall Score
Administrative Competency: Maintaining a Knowledge Base Mean = 4.67 SD = 1.59	Pearson Correlation	.262**	.221**	.278**	.311**	.278**
	Significance	.000	.000	.000	.000	.000
	Mean	4.05	3.83	4.13	3.98	3.98
	Standard Deviation	1.79	1.58	1.70	1.64	1.57

		Teacher Ratings on Technology Integration Competencies				
Phase II		Core Technology Skills	Curriculum, Learning, & Assessment	Classroom & Instructional Management	Professional Practice	Overall Score
Administrative Competency: Maintaining a Knowledge Base Mean = 6.37 SD = 1.56	Pearson Correlation	.221**	.158**	.144*	.255**	.223**
	Significance	.000	.007	.014	.000	.000
	Mean	5.26	4.96	5.38	5.29	5.20
	Standard Deviation	1.76	1.69	1.74	1.67	1.60

** significant < 0.001 level (2-tailed) * significant at the 0.05 level (2-tailed)

In Phase I and Phase II, the correlations were strongest, .311** and .255** respectively, between administrators' maintaining a knowledge base and teachers' professional practices ratings. As in the previous questions, the weakest correlation, .121*, was in curriculum, learning, and assessment in Phase I; but in Phase II, the weakest correlation, .144*, appeared in classroom and instructional management.

Summary

This chapter presented the results of the data analyses. Initially, the data were analyzed to determine the influence of the ND TWTi on administrators' technology integration competencies from Phase I to Phase II. All differences were significant beyond the .001 level indicating that the ND TWTi program had a significant influence on the technology integration competency ratings of both administrators and teachers.

Subsequently, data for each research question were tested using the Pearson Product Moment correlation coefficient. Analyses were carried out for each indicator of administrative competency and technology integration competency to describe findings and to determine correlations. With the exception of the relationship between administrators' leading and managing systemic change and teachers' (a) curriculum, learning, and assessment competency in Phase II; and, (b) classroom and instructional management in Phase II, all correlations were significant. In the aforementioned competencies, there were no relationships. The correlations were significant beyond the .001 level between all administrative competencies and teachers' core technology skills and between teachers' professional practices. The correlations were significant at the .05 level between administrative competencies and teachers' curriculum, learning, and assessment, and teachers' classroom and instructional management. Overall, however, it appears that the ratings of administrators with regard to technology integration competencies are related to the teachers' ratings on technology integration competencies.

The next chapter presents a summary, limitations, and discussion of the findings. Conclusions from the study and recommendations for practice, and for further study, are also presented.

CHAPTER V

CONCLUSIONS

In Chapter V, the investigator presents a summary, the limitations, and a discussion of the findings. The chapter also includes the conclusions of the study and recommendations for practice and for further study.

Summary of the Findings

The purpose of this study was to examine relationships that may reflect the influence school administrators have on teachers' technology skills and technology integration. The study was rooted in the theoretical constructs of both change theory in education (Fullan, 1991; Fullan, 1999) and transformational leadership theory (Burns, 1978; Kouzes & Pozner, 1987). The study used transformational leadership theory to examine the leadership by school administrators and the technology integration competencies of K-12 teachers in North Dakota.

Data obtained from a U.S. Department of Education Technology Literacy Challenge Project was used in this study. The sample consisted of the K-12 teachers and administrators who participated in the North Dakota Teaching with Technology Initiative (ND TWTi) in Phases I and II. Phase I participants included 8,546 teachers and 574 administrators from 423 public and private school buildings throughout North Dakota (Keller, 2001). These numbers account for

89% of the K-12 educators in North Dakota. In Phase II, 5,671 teachers and 394 administrators participated in the project accounting for 59% of North Dakota's K-12 educators (Keller, 2001).

Initially, the data were examined to determine if the ND TWTi influenced the technology integration competency ratings of both administrators and teachers. From the paired samples *t* tests, it was found there were significant positive influences on the ratings from Phase I to Phase II. Teachers and administrators who participated in both phases of ND TWTi rated themselves higher in technology integration competencies after the training provided in Phase I.

Subsequently, data for each research question were tested using the Pearson Product-Moment correlation coefficient. Analyses were carried out for each indicator of administrative competency and technology integration competency to describe findings and to determine correlations. The administrative competency indicators were (a) modeling effective use; (b) leading professional development; (c) leading and managing systemic change; and (d) maintaining a knowledge base. The teacher competencies included: (a) core technology skills; (b) curriculum, learning, and assessment; (c) professional practice; and, (d) classroom and instructional management (Coughlin & Lemke, 1999). With the exception of the relationship between administrators' leading and managing systemic change and teachers' (a) curriculum, learning, and assessment competency in Phase II; and, (b) classroom and instructional management in Phase II, all correlations were significant. The correlations were significant beyond the .001 level between all administrative competencies and teachers' core technology skills and between teachers' professional practices. The correlations were significant at the .05 level between administrative competencies and teachers' curriculum, learning, and assessment, and teachers' classroom and instructional management. Overall, it appears that the ratings of administrators with regard to technology integration competencies are related to teachers' ratings on technology integration competencies.

Limitations

The PCC is a self-reporting tool, which means that administrators and teachers taking the assessment are rating themselves against pre-defined criteria. Subsequently, the results of the PCC may or may not reflect the actual practices of the administrators and teachers who participated in ND TWTi.

The size of the sample was large; in fact, the Phase I sample included 89% of the population of North Dakota teachers and administrators. In most instances, a large sample size is preferable because it more closely reflects the population. In this study, the large sample size included a wide range of variability. The standard deviations in the sample of teachers were quite large, ranging from 1.57 to 1.79. The standard deviations from the sample of administrators ranged from 1.39 to 1.85. The range of variability reduced the robustness of the relationships; therefore, the conclusions in this study must be looked at with caution.

To illustrate, Figure 4 shows a sample correlation of .292** between the ratings of administrators' modeling effective use of technology and ratings of teachers' core technology skills. The figure illustrates the range of variability characteristic of the study. Although the correlations in the study are somewhat weak, they do indicate a relationship between the variables.

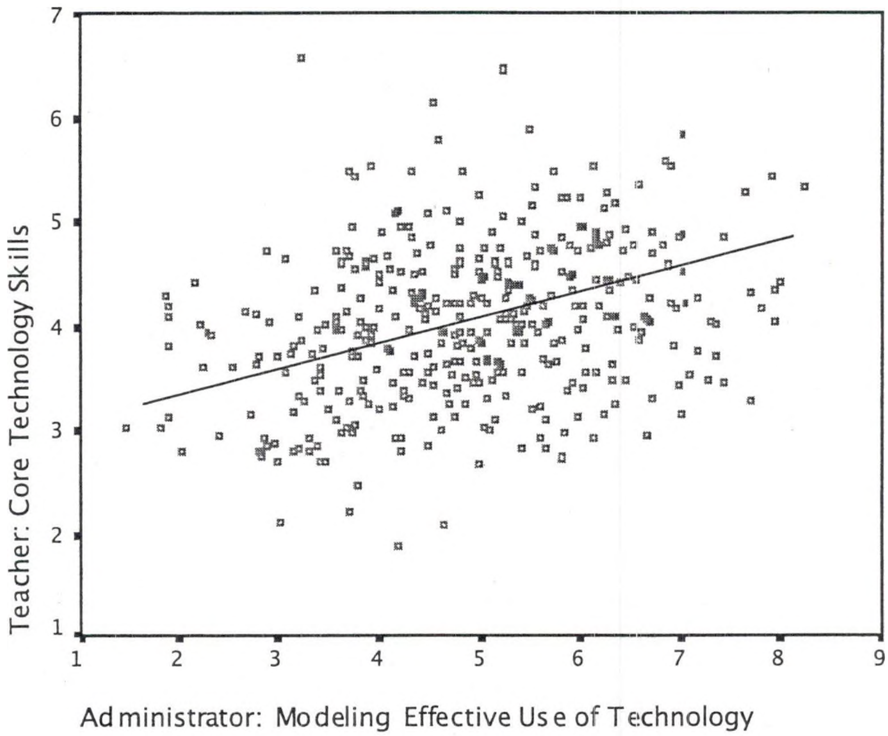

Figure 4. Scatterplot of the Relationship between Ratings of Administrators' Modeling Technology Use and Ratings of Teachers' Core Technology Skills (N = 381, $r = .292^{**}$)

It should be noted, with one exception, that the correlations in Phase I were stronger than those in Phase II. The higher ratings of administrators in both phases meant they had less room for "growth" statistically. Whereas, with teachers' ratings being low in Phase I, their growth tended to be greater. It is likely that this accounts for the weaker correlations between teachers' technology competency ratings and the competency ratings of administrators in Phase II.

Conclusions

The discussion of the research questions is presented in the order of the questions as they appear in the study. The data for the four questions were analyzed using the Pearson Product Moment correlation coefficient.

Question 1. Is there a relationship between ratings of school administrators with regard to modeling effective use of technology and the technology integration competencies of teachers under their leadership? This question aligned with *Model the Way*, one of Kouzes and Posner's (1987) five leadership practices. When transformational leaders are models of the behavior they expect of others, they are demonstrating what Kouzes and Posner (1987) defined as *Model the Way.* By acting as role models, transformational leaders inspire followers to put the good of the whole organization above self-interest. They set the example through daily actions that demonstrate they are deeply committed to their beliefs (Kouzes & Posner, 1987). Leaders must model the use of technology to further the change process. Bailey & Lumley (1997) teach that leaders have to model technology use to be successful technology leaders.

Model the Way is looked at through modeling effective technology use. The mean for administrators' modeling effective use of technology was 5.01. The findings indicate that administrators, as a whole, were close to the midpoint (5.5) in the adaptation stage of modeling effective use of technology. In the adaptation stage, Lemke and Coughlin (1999) illustrate: the administrator is a willing user of basic administrative and learning technologies; and, his/her attitude is noted by the staff and students. In addition, e-mail and voicemail are used regularly, and with the help of others, administrative functions are streamlined. However, it is not until administrators reach the transformation stage (7.5 – 10), that Lemke and Coughlin (1999) state, "administrators are excellent role models for the effective use of technology" (p. 38).

The smallest increase in administrators' ratings occurred in modeling effective technology use. Because ND TWTi was focused on technology integration in instruction and not on teaching specific technology skills, it may account for lesser increase. Also, the standard deviation was the smallest of any of the administrator areas. Modeling effective use of technology is a concrete area while the other three competency areas are more abstract. This may indicate that administrators more clearly know where to rate their technology skill abilities on the PCC, and may account for lesser variability in both phases.

The correlations were examined between modeling effective use of technology by administrators and the technology integration competencies of teachers. In Phase I, the correlations in the five teacher competency areas were positive and significant beyond the .001 level. The correlations between administrators' modeling effective technology use ranged from .223** with teachers' curriculum, learning, and assessment competency area, to .296** with teachers' professional practice area. In Phase II, the correlations between administrators' modeling effective technology use ranged from .141* with classroom and instructional management area, to .241** with teachers' professional practice area. The correlations indicate that modeling the effective use of technology by administrators may be a determinant in the technology integration competency ratings of teachers under their leadership.

Kouzes and Posner (1987) insist that leaders *Model the Way*. The PCC results indicate that administrators in North Dakota are functioning in the adaptation stage in modeling effective use of technology. Lemke and Coughlin (1999) maintain that when administrators reach the transformation stage, they are effective role models. Would the correlations be stronger if administrators were functioning in the transformation stage? That is a question for further study.

Question 2. Is there a relationship between ratings of school administrators with regard to leading professional development and the technology integration competencies of teachers under their leadership? This question was aligned with Kouzes and Posner's (1987) practice called *Enable Others to Act*. When *Enabling Others to Act*, leaders foster collaboration and build spirited teams. They actively involve others. Leaders create an atmosphere of trust. They make each person feel capable and powerful (Kouzes & Posner, 1987). The ACOT research indicated the most crucial factor determining whether teachers successfully integrated technology into their classroom was the level of support they received from school administrators (Sandholtz et al., 1997).

In this study, *Enabling Others to Act* will be investigated by examining the competency: leading professional development. The mean for administrators' leading professional development was 4.27. The findings indicate that ND administrators, as a whole, were at the lower end of the scale (3.5 – 7.49) in the adaptation stage of leading professional development. In the adaptation stage, Lemke and Coughlin (1999) illustrate: “the administrator takes an active role in facilitating the professional development of staff related to technology. The administrator conducts assessments and ensures that training supports the school curriculum and existing instructional practice” (p. 38). It is not until administrators reach the transformation stage (7.5 – 10), that Lemke and Coughlin (1999) state “the administrator considers professional development to be of critical importance” (p. 38). At this level, professional development for teachers includes a wide variety of collaborative activity in addition to more conventional training. The administrator is able to create and sustain a culture that values experimentation with new approaches and learns from failures as well as successes (Lemke & Coughlin, 1999).

In the study, the relationships were examined between leading professional development by administrators and the technology integration competencies of teachers. In Phase I, the correlations in the five teacher competency areas were positive and significant beyond the .001 level. The correlations between administrators' leading professional development ranged from .188** with teachers' curriculum, learning, and assessment, to .224** with teachers' professional practice. In Phase II, the correlations between administrators' leading professional development ranged from .117* with teachers' classroom and instructional management area competency area, to .212** with teachers' professional practice. The correlations indicate that leading professional development by administrators may be a determinant in the technology integration ratings of teachers under their leadership.

Kouzes and Posner (1987) advocate *Enabling Others to Act*. The PCC results indicate that administrators in North Dakota are functioning in the low adaptation stage in leading professional development. The data in this study indicate that administrators' leading professional development may be a factor that influences technology integration by teachers.

Why are North Dakota administrators' ratings low in leading professional development? Perhaps administrators don't value professional development as a means of promoting technology integration. Another limiting factor in North Dakota may be the structure of the school day. State law does not allow schools to count a day as a school day if students are not present. Therefore, professional development usually occurs before or after school, and in between those times, teachers are teaching their students. Teachers are not always receptive to, or fully engaged in, training under those conditions. A third factor may be the inability to find adequate professional development expertise or resources.

Recently, when discussing the findings of this study with a classroom teacher, the teacher stated, "Teachers don't associate technology staff development with administrators – they associate it with the TNT conference. That's where teachers learn about technology" (R. Feldner, personal communication, March 4, 2003). The TNT (Teaching and Technology) conference is an annual conference in North Dakota with both hands-on workshops and one-hour sessions. The conference focuses on using technology in education. Perhaps that attitude is pervasive and administrators are not associated with technology implementation.

Another aspect of *Enabling Others to Act* is support. Administrators may not understand the importance of supporting their teachers as they integrate technology in their curriculum. Perhaps administrators underestimate the value of collaboration and sharing among their teachers. More importantly, the administrator may lack the knowledge base to understand the importance of support and professional development. Knowledge base will be explored further in question four, because it represents another of the practices in Kouzes and Posner's (1987) framework.

Question 3. Is there a relationship between the ratings of school administrators with regard to leading and managing systemic change and the technology integration competencies of teachers under their leadership? This question was aligned with Kouzes and Posner's (1987) practice called *Challenge the Process.* To *Challenge the Process*, leaders search for opportunities to change the status quo. They look for innovative ways to improve the organization. They take risks (Kouzes & Posner, 1987). Perry and Areglado (2001) found that technology leaders send implicit and explicit messages that create a sense of urgency, guide the implementation strategy, and create change in the whole school.

Challenge the Process is looked at through leading and managing systemic change. The mean for administrators' leading and managing systemic change was 5.03. The findings indicate that ND administrators, as a whole, were mid-range on the scale (3.5 – 7.49) in the adaptation stage of leading and managing systemic change. In the adaptation stage, Lemke and Coughlin (1999) state, "the administrator is knowledgeable in the theory and process of systemic change. They are engaging the staff in systemic change on a regular basis, and the administrator is developing increased confidence in his/her ability to manage this process" (p. 38).

In analyzing data for *Challenge the Process*, relationships were examined between leading and managing systemic change by administrators and the technology integration competencies of teachers. In Phase I, the correlations in the five teacher competency areas were positive and significant beyond the .05 level. The correlations between administrators' leading and managing systemic change ranged from .121* with teachers' curriculum, learning, and assessment competency area, to .192** with teachers' core technology skills. Although weak, the correlations indicate that leading and managing systemic change by administrators may be a determinant in the technology integration ratings of teachers under their leadership.

In Phase II, there were no relationships between the administrators' leading and managing systemic change and teachers' (a) curriculum, learning, and assessment; and (b) classroom and instructional management. It appears that administrators' ratings in leading and managing systemic change have no influence on teachers' curriculum, learning, and assessment or on classroom and instructional management.

It may be that administrators do not have time to lead curricular reforms. According to two national surveys (Doud & Keller, 1998; NASSP, 2001), principals report that establishing a learning climate and curricular leadership are among the most important aspects of their role as principal; however, they spent less time doing curricular or learning tasks during a typical week than they spend with management or discipline-related issues. In addition, principals may require more professional development. The survey of high school principals (NASSP, 2001) reported that over half of the principals responding need some additional training in student assessment and curriculum development.

It should be noted that the Phase II mean for administrators in leading and managing systemic change was 7.43, which puts them very near the transformational area (7.5-10) of the PCC. Administrators' mean ratings in leading and managing systemic change increased by 2.40 from Phase I to Phase II. This is the largest increase in any competency area, administrators or teachers. In the teacher ratings, there were no sample means that approached the transformation level. The teacher overall mean (5.20) in Phase II was solidly near the middle of the adaptation level (3.5-7.49). It appears that administrators are somewhat confident in their ability to lead and manage systemic change in Phase II. Unfortunately, the correlations between administrators' leading and managing system change and teachers' curriculum, learning, and assessment competency and the classroom and instructional practice competency were not significant. This means even though administrators rated themselves high in leading and managing systemic change, it did not influence the ratings of teachers in those competency areas.

There may be another explanation for the greatest increase in administrators' ratings occurring in the area of leading and managing systemic change. It appears that administrators felt more comfortable leading and managing systemic change after attending the first phase of ND TWTi. The content in the administrator strand of ND TWTi focused on leadership, change, and attitudes toward change with regard to technology in K-12 schools (Technology Innovation Challenge Grant Program Performance Report, 2001). It seems logical that this content and focus may have led to the greater increase in the ratings for leading and managing systemic change.

Perhaps administrators do not understand the change process as it relates to technology. They may witness their teachers using technology and believe that change is occurring. A major aspect to leading and managing systemic change is the amount of time available to administrators. In a 2001 survey of secondary school principals (NASSP, 2001), the principals cited lack of time as a roadblock to doing their job. Even though principals felt that program development should have been their first priority, they spent more time on school management issues. It is difficult to affect meaningful change when there is a lack of time to plan, implement, and evaluate instructional programming.

Whether or not teachers are using that technology effectively with students may not be obvious to the administrator. This leads to the knowledge base of the administrator. Once again, the leadership practice, maintaining a knowledge base, is interacting with another practice. This time it is with *Challenge the Process*.

Another interesting finding is the Phase II correlation (.220**) between administrators' leading and managing systemic change and teachers' professional practice. It is the only area where the strength of the correlation increased from Phase I to Phase II. Perhaps administrators strongly urged or required teachers to participate in Phase II of ND TWTi. Because the teachers were enrolled in a professional development activity it may have led teachers to rate their own professional practices higher.

Question 4. Is there a relationship between ratings of school administrators with regard to maintaining a knowledge base and the technology integration competencies of teachers under their leadership? This question was also aligned with Kouzes and Posner's (1987) practice called *Challenge the Process*. To *Challenge the Process*, leaders search for opportunities to change the status quo. They look for innovative ways to improve the organization. They take risks. Leaders search for opportunities to innovate, grow, and improve (Kouzes & Posner, 1987). Bennis (1993) stated, "Leaders create a climate in which conventional wisdom can be challenged, and one in which errors are embraced rather than shunned in favor of safe, low-risk goals" (p. 168).

In this question, *Challenge the Process* will be looked at through maintaining a knowledge base. The mean for administrators in this competency was 4.67. The findings indicate that ND administrators, as a whole, were at the lower end of the scale (3.5 – 7.49) in the adaptation stage of maintaining a knowledge base. In the adaptation stage, Lemke and Coughlin (1999) state,

> The administrator has a working knowledge of effective practices related to instructional technology. This knowledge may be limited, and there is often no strategy in place for staying abreast of new developments. Enough is known, however, to avoid ineffective practices and to discuss potentially effective ones with teachers. (p. 38)

The relationships were examined between maintaining a knowledge base by administrators and the technology integration competencies of teachers. In Phase I, the correlations in the five teacher competency areas were positive and significant beyond the .001 level. The correlations between administrators' maintaining a knowledge base ranged from .262** with teachers' curriculum, learning, and assessment competency area, to .311** with teachers' core technology skills. In Phase II, the correlations between administrators' maintaining a knowledge base ranged from .221** with teachers' core technology skills, and .144* with teachers' curriculum learning and assessment. The correlations indicate that maintaining a knowledge base by administrators may be a determinant in the technology integration ratings of teachers under their leadership. As a group, the correlations, for administrators' maintaining a knowledge base, were the strongest of the administrative competency areas.

Why does maintaining a knowledge base result in slightly stronger correlations? Why did results in two of the previous questions imply a possible interaction with maintaining a knowledge base? In keeping with the ACOT research and the Seven Dimensions, educators pass through stages of development with regard to technology integration. By rating themselves at 4.67 in maintaining a knowledge base, administrators claim they have passed through the entry stage of the competency. By examining the entry stage of maintaining a knowledge base, insight may be gained into this competency area.

In describing the behavior of an administrator functioning at the entry stage, Lemke and Coughlin (1999) describe,

> The administrator is aware of the existence of literature related to the effective use of learning technologies, he/she lacks the time, access, or interest to familiarize him/herself with this knowledge. At this stage, the administrator may simply accept any use of technology that is not obviously detrimental to learning as acceptable, abdicating responsibility for evaluating classroom practice. (p. 38)

Administrators functioning at the entry stage may not recognize the need, or the type, of professional development necessary to support technology integration. They may not recognize the necessity of allowing teachers to collaborate and share what "works" with regard to technology integration. Becker's findings (1999) confirm that successful integration of technology into the classroom requires the availability of quality technology support. Support is not just technical support but, in large part, instructional support that includes individualized training and professional development that focuses on instruction and integration. Quite possibly, administrators functioning at the entry stage may not *Enable Others to Act* because they do not have the supporting knowledge base in instructional technology.

Administrators functioning at the entry stage may not recognize effective use of technology in the classroom environment. They may not recognize the change involved in moving from a teacher-centered environment to a student-centered environment. They may not understand the mechanics behind new learning strategies such as problem-based learning or inquiry-based learning. Even if administrators claim they can *Challenge the Process* by leading and managing systemic change, will they know what that change is without an adequate knowledge base? Perhaps administrators rated themselves too high in maintaining a knowledge base. Maybe they don't know what they don't know.

Discussion of the Findings

While the role of the administrator has been highly touted as significant in school improvement activities, little or no information exists which describes the specific roles and responsibilities of the administrator as a technology leader who is involved with restructuring schools with emerging technologies (Bailey, 2001). The purpose of this study was to examine relationships that may reflect the influence school administrators have on teachers' technology skills and technology integration. The findings seem to agree that administrators have a leadership role in technology integration.

Cause and effect is hard to demonstrate and there is always the potential for an opposite conclusion to be reached. In this case, the investigator did not spend time determining whether the technology integration competencies ratings of teachers have a role in the administrative competency ratings of administrators. Nor did the investigator spend time determining whether a confounding factor in the form of an external agency, ND TWTi, may effect technology integration. Both of these are issues for further study.

The literature established that millions of dollars have been spent to equip schools with technology. Consequently, technology is widely available for use by K-12 teachers. Even though research supports the positive impact of technology on student achievement, teachers do not integrate technology into the curriculum in rich and meaningful ways. The literature substantiated the idea that administrators' leadership is crucial in the integration of technology in schools. Transformational leadership, in fact, may provide the framework to more effectively integrate technology in K-12 schools.

Analyses of the data were two-fold. First, it was determined that the ND TWTi significantly and positively influenced the technology integration competency ratings of both administrators and teachers. Second, correlations indicate that the administrative competencies (a) modeling effective use of technology; (b) leading professional development; (c) leading and managing systemic change; and, (d) maintaining a knowledge base, may be determinants in the technology integration competency ratings of teachers under their leadership.

The Five Practices of Exemplary Leadership (Kouzes & Posner, 1987) provided the framework for this study. The practices include *Inspire a Shared*

Vision, Model the Way, Challenge the Process, Enable Others to Act, and *Encourage the Heart*.

Although, not measured in this study, *Inspire a Shared Vision* was implicit in the ND TWTi Seven Dimension structure. Coughlin states, "One of the things we learned in implementing the Seven Dimensions is that vision is the key. People need to have pictures in their heads of what powerful practice looks like" (personal communication, March 4, 2003). The Office of Technology Assessment (1995) identified a shared vision for the use of technology to support curriculum as a factor in the effective use of technology by teachers. In addition, the ACOT research revealed that administrators who worked with their staff to create a shared vision, eased tensions among teachers and fostered teacher collaboration rather than competition (Sandholtz et al., 1997). Administrators must develop, with their staff, a shared vision for the effective use of technology in the K-12 classroom.

Administrators need to *Challenge the Process*. If they are going to change the way technology is used in schools, they must become leaders in the process. Costello (1997) focuses on two key points. As school districts plan for technology, they must keep in mind two issues: (a) technology has the potential to change how we work, teach, and learn in our school districts; and (b) this potential will only be realized if administrators assume the lead role in realizing this potential. Successful instructional transformation obliges leaders to be actively involved in all aspects of the process.

The role of the teacher is critical to the successful integration of technology in the K-12 classroom. Re-emphasizing what the ACOT research found, teachers who are using technology need hands-on experience, opportunities for reflection, and interaction with their colleagues (Sandholtz et al., 1997). Both prospective and practicing teachers should learn about technology integration in an environment that closely resembles the learner-centered classroom they are expected to design for their own students. Teachers should experience technology-enhanced, engaged learning in a classroom setting. Administrators need to *Enable Others to Act*. They need to encourage, enable, and provide incentives to facilitate this process. Enabling their teachers to better integrate technology involves collaboration, sharing best practices, encouraging and allowing teachers to take risks.

As teachers make progress in integrating technology, leaders must acknowledge them, in other words, *Encourage the Heart*. Because integrating technology is often a complex process, it is even more imperative that administrators celebrate the accomplishments of teachers as they create new environments for their students. Kouzes and Posner (2002) remind us that leaders encourage their followers by showing appreciation for individual excellence, celebrating accomplishments, and recognizing contributions.

As Secretary Paige stated, "It's not enough to have a computer and an Internet connection in the classroom if they are not turned on. It's not even enough to turn them on if they are not integrated into the curriculum. And it's pointless to integrate them into the curriculum if they don't add value to student performance" (Paige, 2002). It is incumbent upon school administrators to ensure that the previous statement is not a reality in K-12 schools. Administrators must be active leaders to ensure that students are provided with new learning opportunities and environments. Environments that engage students in activities that have educational technology skills and relevant curricular content interwoven.

Recommendations

Recommendations for Practice

The conclusions of this study led to the following recommendations regarding the integration of technology in K-12 schools. The first indicates that further professional development is needed for practicing administrators, and the second espouses that educational administration programs more fully integrate technology into their programs. Third, steps administrators must take in implementing technology integration in schools are recommended, and lastly, professional development in the evaluation of student products using technology should be expanded.

1. Administrators need to maintain their knowledge base. The ND Educational Technology Council, ND EduTech, and ND Lead Center need to continue to provide professional development opportunities for administrators that enhance their knowledge of technology integration and leadership. Professional development should show effective technology integration by classroom teachers. Participants should actually experience classrooms where effective technology integration is taking place. They need to have pictures in

their heads of what powerful practice looks like. Similarly, administrators and teachers should recognize student work produced when technology is used appropriately.

2. Peterson's (2000) study of principals' roles in technology-rich schools indicated principals preferred that technological skills and knowledge material be covered both in separate courses and be integrated into the current curriculum. Educational administration professors should consider changing current curriculum models. They should incorporate technology into teaching and learning. This requires educational administration professors to possess or acquire skills using technological tools. Courses in educational leadership should not only incorporate the use of technology skills in the course, but should be designed so that students learn the skills by virtue of completing course requirements. In essence, education administration professors need to *Model the Way*.

3. At the school level, administrators, together with teachers, parents, and students, should develop a shared vision of student learning through the use of the technology. That vision should support the school's goals, expectations, and criteria for improvement in student learning. Along with the vision, a realistic timeframe for implementation should be developed. In developing the timeframe, administrators need to recognize that new technologies, skills, and practices take time to become effective parts of teachers' and students' daily routines. Ongoing, extensive, and research-based professional development opportunities and technical support must be provided to help teachers use technology to develop

meaningful instructional strategies for students. Administrators must provide teachers with ongoing support, both technical and instructional. They must evaluate technology integration efforts through observation and assessment in order to drive successful implementation. Finally, administrators must celebrate successful technology integration efforts in their schools.

4. Professional development for teachers and administrators must include evaluation of student products. In North Dakota, EduTech provides minimal professional development relating to the evaluation of student products. This opportunity needs to be greatly expanded by EduTech, the ND Lead Center, and the universities having teacher education programs. Through this evaluation, teachers and administrators can see what the end product from effective technology integration should look like. They need concrete examples to develop the vision, or picture, needed to take with them to spark their own integration efforts. The North Central Regional Educational Laboratory is an excellent resource for this professional development in this area.

5. Knowledge of leadership theories and models is expected of school administrators. However, technology coordinators are expected to be well versed in the technical aspects of educational technology but often do not consider themselves in a leadership role. This study has helped me realize the leadership models play in educational technology integration and implementation. The North Dakota Association of Technology Leaders should provide literature and professional development in the area of transformational leadership for their

membership. I believe it would enhance their abilities to lead the effective use of technology in schools.

Recommendations for Further Study

The ND TWTi contains a wealth of data that relates to technology integration in K-12 schools in North Dakota. Based on this study, the recommendations that follow are suggested for further study regarding technology integration in North Dakota K-12 schools.

1. Further study should be conducted using data from administrators with transformational ratings on the PCC to determine the relationship to the technology competency ratings of teachers in their schools.

2. Further study should be conducted using data from administrators with entry-level ratings on the PCC to determine the relationship to the technology competency ratings of teachers in their schools.

3. Further study should be conducted using data from administrators' competency ratings on the PCC, and the extent in which teachers, who the administrators supervise, participated in additional phases of ND TWTi.

4. Further study should be conducted using data from administrators' competency ratings on the PCC to determine the extent to which teachers, who the administrator supervises, integrate technology into their curriculum.

5. Further study should be conducted using Kouzes and Posner's (2002) Leadership Practices Inventory with the administrator participants in the ND TWTi to provide validity data for their transformational leadership framework.

6. Further study should be conducted using data from administrators' and teachers' competency ratings on the PCC. The data should be analyzed by age, levels of education, years in education, years employed in each school, gender, and content area.

7. Further study should be conducted comparing the technology plans of schools and the PCC competency ratings of the administrators from those schools.

8. Further study should be conducted comparing the PCC competency ratings of administrators and the results of the TAGLIT (Taking a Good Look at Instructional Technology) surveys for administrators who participated in the Technology Academy of School Leaders.

9. Further study should be conducted that compares the portfolios of teachers who participated in ND TWTi and their PCC technology integration competency ratings.

10. Further study should be conducted that compares the competency ratings of administrators on the PCC and the school improvement goals in their school to determine if there is a relationship between those with and without technology related goals.

11. Further study should be conducted that documents the leadership practices in schools in North Dakota which have conducted technology audits.

12. Further study should be conducted that documents the practices of school boards with regard to educational technology. Issues directly impacting

technology such as funding, staffing, vision, and priority would be valuable data sets for school leaders.

13. Further study should be conducted on the confounding effects of the external agency, ND TWTi, on technology integration in ND schools.

14. Further study should be conducted on the effect of technology integration by teachers on the administrative competencies of school administrators.

This chapter presented a summary of the findings, limitations, discussion, conclusions, and recommendations for practice and further study on technology integration by K-12 administrators and teachers. If technology is to be integrated into the curriculum in meaningful and effective ways, then administrators must have an understanding of technology integration and their own leadership role in making integration successful.

APPENDICES

APPENDIX A

LETTER OF CONSENT

Tanna M. Kincaid
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April 15, 2003

To Whom It May Concern:

As Director for the North Dakota Teaching with Technology Initiative (TWTi) I hereby give Lisa Feldner permission to use data derived from the TWTi Professional Competency Continuum Assessment for teachers and administrators and report results in aggregate form only.

This use is confined to activities associated with doctorial research. All individual results must be kept in strict confidence. All files and data will be kept secure and appropriate measures will be taken to protect data security at the conclusion of the research.

Sincerely,

Tanna Kincaid

Tanna Kincaid
TWT Director

APPENDIX B

DEMOGRAPHICS OF SAMPLE

DEMOGRAPHICS OF THE POPULATION

Size of School	Frequency	Percentage
Less than 250 students	123	33.5
250 - 749 students	110	30.0
More than 750 students	134	36.5
Total	367	100.0

	FEMALE		MALE	
TWT Participation by Teachers	Frequency	Percentage	Frequency	Percentage
Phase I	5,861	77.0	1,749	23.0
Phase II	4,307	77.0	1,285	23.0
Both Phase I & II	3,974	77.1	1,181	22.9

	FEMALE		MALE	
TWT Participation by Administrators	Frequency	Percentage	Frequency	Percentage
Phase I	168	37.3	282	62.7
Phase II	118	34.1	228	65.9
Both Phase I & II	107	36.0	190	64.0

	FEMALE		MALE	
Grade Level of Administrators	Frequency	Percentage	Frequency	Percentage
Elementary School	137	26.9	127	25.0
Middle School	12	2.4	40	7.9
High School	40	7.9	153	30.1
Total	189	37.1	320	62.9

	FEMALE		MALE	
Grade Level of Teachers	Frequency	Percentage	Frequency	Percentage
Elementary School	3,901	48.5	402	5.0
Middle School	829	10.3	443	5.5
High School	1,464	18.2	1,008	12.5
Total	6,194	77.0	1,853	23.0

	FEMALE		MALE	
Education Level of Administrators	Frequency	Percentage	Frequency	Percentage
Associates degree	2	0.4	1	0.2
Bachelors degree	58	11.6	104	20.8
Masters degree	97	19.4	197	39.5
Doctorate degree	9	1.8	6	1.2
Other	13	2.6	12	2.4
Total	179	35.9	320	64.1

Education Level of Teachers	FEMALE Frequency	FEMALE Percentage	MALE Frequency	MALE Percentage
Associates degree	10	0.1	10	0.1
Bachelors degree	4,420	54.9	1,241	15.4
Masters degree	1,725	21.4	575	7.1
Doctorate degree	8	0.1	8	0.1
Other	31	0.4	19	0.2
Total	6,194	77.0	1,853	23.0

Administrator Total Number of Years in Education	FEMALE Frequency	FEMALE Percentage	MALE Frequency	MALE Percentage
Less than 6	33	7.0	31	6.6
6 - 10	20	4.2	37	7.8
11 - 20	46	9.7	85	18.0
21 - 30	53	11.2	109	23.0
Over 30	18	3.8	41	8.7
Total	170	35.9	303	64.1

Teacher Total Number of Years in Education	FEMALE Frequency	FEMALE Percentage	MALE Frequency	MALE Percentage
Less than 6	989	12.9	337	4.4
6 - 10	920	12.0	276	3.6
11 - 20	1,902	24.8	456	5.9
21 - 30	1,702	22.2	505	6.6
Over 30	376	4.9	213	2.8
Total	5,889	76.7	1,787	23.3

Administrator Distribution by Region	FEMALE Frequency	FEMALE Percentage	MALE Frequency	MALE Percentage
Region 1 – Williston	18	3.6	42	8.4
Region 2 – Minot	20	4.0	44	8.8
Region 3 – Devils Lake	25	5.0	31	6.2
Region 4 – Grand Forks	26	5.2	33	6.6
Region 5 – Fargo	21	4.2	48	9.6
Region 6 – Valley City	16	3.2	46	9.2
Region 7 – Bismarck	25	5.0	41	8.2
Region 8 – Dickinson	28	5.6	35	7.0

Teacher Distribution by Region	FEMALE Frequency	FEMALE Percentage	MALE Frequency	MALE Percentage
Region 1 – Williston	656	8.2	207	2.6
Region 2 – Minot	772	9.6	221	2.7
Region 3 – Devils Lake	704	8.7	193	2.4
Region 4 – Grand Forks	799	9.9	233	2.9

Region 5 – Fargo	930	11.6	227	2.8
Region 6 – Valley City	635	7.9	252	3.1
Region 7 – Bismarck	1038	12.9	323	4.0
Region 8 – Dickinson	660	8.2	197	2.4

	FEMALE		MALE	
Primary Assignment - Administrators	Frequency	Percentage	Frequency	Percentage
Superintendent	10	2.0	50	10.0
Building Principal	78	15.6	114	22.8
Elementary Principal	50	10.0	53	10.6
Secondary Principal	12	2.4	77	15.4
Special Education Director	3	0.6	0	0.0
Technology Coordinator	24	4.8	21	4.2
Vocational Director	1	0.2	3	0.6
Other	0	0.0	2	0.4
Total	179	35.9	320	64.1

	FEMALE		MALE	
Primary Assignment - Teachers	Frequency	Percentage	Frequency	Percentage
Agriculture Education	2	0.0	14	0.2
Art	50	0.6	19	0.2
Business Education	108	1.3	85	1.1
Computer Science	16	0.2	10	0.1
Counselor	172	2.1	55	0.7
Family/Consumer Science	102	1.3	0	0.0
Foreign Language	82	1.0	12	0.1
General Elementary	2,442	30.3	286	3.6
Kindergarten	163	2.0	3	0.0
Language Arts	515	6.4	90	1.1
Librarian	166	2.1	6	0.1
Marketing Education	3	0.0	7	0.1
Mathematics	234	2.9	220	2.7
Music/Band	253	3.1	74	0.9
Performing Arts	11	0.1	8	0.1
Physical Education	136	1.7	145	1.8
Pre-School/Early Childhood	90	1.1	1	0.0
Science	169	2.1	251	3.1
Social Science	124	1.5	264	3.3
Special Education	734	9.1	44	0.5
Technical and Health Education	16	0.2	5	0.1
Technology Coordinator	34	0.4	12	0.1
Technology Education	9	0.1	59	0.7
Title	237	2.9	4	0.0
Trades Education	1	0.0	8	0.1
Visual Arts	24	0.3	5	0.1
Vocational Education	101	1.3	95	1.2
Other/None	200	2.4	71	0.8
Total	6,194	77.0	1,853	23.0

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