Elementary School Administrator Technology Skills And Their Impact On Teacher Technology Integration Competencies

Jason Douglas Hornbacher

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ELEMENTARY SCHOOL ADMINISTRATOR TECHNOLOGY SKILLS AND THEIR IMPACT ON TEACHER TECHNOLOGY INTEGRATION COMPETENCIES

by

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A Dissertation
Submitted to the Graduate Faculty
of the
University of North Dakota
in partial fulfillment of the requirements
for the degree of
Doctor of Education

Grand Forks, North Dakota
August
2007

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[Signatures]

Chairperson

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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Dean of the Graduate School

Date

August 7, 2007
Title               Elementary School Administrator Technology Skills and Their Impact on Teacher Technology Integration Competencies
Department        Educational Leadership
Degree               Doctor of Education

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Date                     [July 7, 2007]
TABLE OF CONTENTS

LIST OF TABLES.................................................................................................................. viii

ACKNOWLEDGEMENTS........................................................................................................ x

ABSTRACT ........................................................................................................................... xii

CHAPTER

I. INTRODUCTION............................................................................................................. 1

  Purpose of the Study and Research Questions ......................................................... 4
  Need for the Study ........................................................................................................ 5
  Delimitations of the Study ......................................................................................... 7
  Assumptions ................................................................................................................ 7
  Definitions of the Terms ........................................................................................... 8
  Organization of the Study ......................................................................................... 10

II. REVIEW OF LITERATURE .......................................................................................... 11

  Modeling Effective Use and Maintaining a Knowledge Base .................................. 12
    Access to Technology in the Classroom ................................................................. 12
    Student Technology Standards .............................................................................. 13
    Teacher Technology Standards ............................................................................. 14
    Administrative Technology Standards ................................................................. 15
    The Digital Age ....................................................................................................... 16
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology Professional Development</td>
<td>18</td>
</tr>
<tr>
<td>Investing in Technology</td>
<td>18</td>
</tr>
<tr>
<td>Technology Use in Schools</td>
<td>20</td>
</tr>
<tr>
<td>Types of Technology Professional Development</td>
<td>21</td>
</tr>
<tr>
<td>Leading and Managing Systematic Technology Change</td>
<td>23</td>
</tr>
<tr>
<td>Transformational Leadership Summary</td>
<td>23</td>
</tr>
<tr>
<td>Leadership, Change, and Technology</td>
<td>26</td>
</tr>
<tr>
<td>North Dakota Teaching with Technology Initiative (TWTi)</td>
<td>30</td>
</tr>
<tr>
<td>Technology Integration in North Dakota</td>
<td>30</td>
</tr>
<tr>
<td>Impact of TWTi in North Dakota</td>
<td>34</td>
</tr>
<tr>
<td>III. THE PURPOSE OF THE STUDY</td>
<td>35</td>
</tr>
<tr>
<td>Research Population</td>
<td>36</td>
</tr>
<tr>
<td>Survey Instrument</td>
<td>37</td>
</tr>
<tr>
<td>Professional Competency Continuum</td>
<td>37</td>
</tr>
<tr>
<td>Data Collection Procedures</td>
<td>41</td>
</tr>
<tr>
<td>Statistical Treatment of Data</td>
<td>41</td>
</tr>
<tr>
<td>IV. ANALYSIS OF THE DATA</td>
<td>43</td>
</tr>
<tr>
<td>Research Questions</td>
<td>49</td>
</tr>
<tr>
<td>V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS</td>
<td>58</td>
</tr>
<tr>
<td>Summary</td>
<td>58</td>
</tr>
<tr>
<td>Conclusions</td>
<td>63</td>
</tr>
<tr>
<td>Question 1 Conclusions</td>
<td>63</td>
</tr>
<tr>
<td>Question 2 Conclusions</td>
<td>65</td>
</tr>
</tbody>
</table>
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Technology Indicators and Number of Questions per Indicator Grouped by Teacher Competencies from the Professional Competency Continuum</td>
<td>39</td>
</tr>
<tr>
<td>2.</td>
<td>Technology Indicators and Number of Questions per Indicator Grouped by Administrator Competencies from the Professional Competency Continuum</td>
<td>40</td>
</tr>
<tr>
<td>3.</td>
<td>Demographic Data from the Administrator and Teacher Professional Competency Continuum V and VI</td>
<td>45</td>
</tr>
<tr>
<td>4.</td>
<td>Mean and Standard Deviation of Administrator Ratings of Administrative Competencies on the Professional Competency Continuum V</td>
<td>47</td>
</tr>
<tr>
<td>5.</td>
<td>Mean and Standard Deviation of Administrator Ratings of Administrative Competencies on the Professional Competency Continuum VI</td>
<td>47</td>
</tr>
<tr>
<td>6.</td>
<td>Mean and Standard Deviation of Teacher Ratings of Technology Integration Competency on the Professional Competency Continuum V</td>
<td>48</td>
</tr>
<tr>
<td>7.</td>
<td>Mean and Standard Deviation of Teacher Ratings of Technology Integration Competency on the Professional Competency Continuum VI</td>
<td>49</td>
</tr>
<tr>
<td>8.</td>
<td>Correlations between Administrator Ratings of Modeling Effective Use of Technology and Teacher Ratings of Technology Integration Competencies on the PCC V</td>
<td>51</td>
</tr>
<tr>
<td>9.</td>
<td>Correlations between Administrator Ratings of Modeling Effective Use of Technology and Teacher Ratings of Technology Integration Competencies on the PCC VI</td>
<td>51</td>
</tr>
<tr>
<td>10.</td>
<td>Correlations between Administrator Ratings of Leading Professional Development and Teacher Ratings of Technology Integration Competencies on the PCC V</td>
<td>52</td>
</tr>
</tbody>
</table>
11. Correlations between Administrator Ratings of Leading Professional Development and Teacher Ratings of Technology Integration Competencies on the PCC VI ................................................................. 53

12. Correlations between Administrator Ratings of Leading and Managing Systematic Change and Teacher Ratings of Technology Integration Competencies on the PCC V ................................................................. 54

13. Correlations between Administrator Ratings of Leading and Managing Systematic Change and Teacher Ratings of Technology Integration Competencies on the PCC VI ................................................................. 55

14. Correlations between Administrator Ratings of Maintaining a Knowledge Base and Teacher Ratings of Technology Integration Competencies on the PCC V ................................................................. 56

15. Correlations between Administrator Ratings of Maintaining a Knowledge Base and Teacher Ratings of Technology Integration Competencies on the PCC VI ................................................................. 57
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Finally, I would like to thank my parents for encouraging me to explore life at an early age. I am proud to be your son!
ABSTRACT

The purpose of this study was to examine the relationships between the technology competencies of elementary school administrators and the technology integration competencies of teachers under their leadership. This study examined data from Phases V and VI, which were the last year and the year following the end of the North Dakota Teaching with Technology Initiative (ND TWTi).

The data collection tool was the Professional Competency Continuum (PCC) profile assessment. The data from this survey were preexisting and spanned from 1999 to 2006. ND TWTi provided technology training and support to North Dakota teachers and administrators. The PCC measured the technology competencies of teachers and administrators in relation to the national technology standards. The PCC identified five key target areas for improving educational technology which included core technology skills, curriculum, learning and assessment, professional practices, classroom and instructional management, and administrative competencies. Each competency area allowed the respondent to answer questions which then placed the respondent on a continuum. The continuum stages ranged from Entry, Adaptation, to Transformation.

The mean values of administrators from PCC I to PCC VI continue to show that administrators are moving toward the transformation end of the spectrum. Administrator ratings on the PCC V and VI are in the upper range of adaptation with mean values
ranging from 6.96 to 7.74. The mean values of teachers increased from Phase II to the 
PCC V but then all mean values dropped from the PCC V to PCC VI.

Previous research documented a correlation between all North Dakota 
administrator ratings on the Professional Competency Continuum and the technology 
integration competencies of teachers who worked for them during Phases I and II of ND 
TWTi. The previous research concluded that the ratings of administrators with regard to 
technology integration competencies are related to teachers’ ratings on technology 
integration competencies.

The successes of the ND TWTi and its associated professional development for 
teachers and administrators across the state of North Dakota are documented in PCC I, 
II, III, and IV. However the PCC V and VI, and this study do not corroborate the same 
findings.
CHAPTER I
INTRODUCTION

Prior to the National Education Technology Plan of 2004, a comprehensive study of the past 20 years of education technology policy was conducted by the United States Department of Education Office of Educational Technology. This policy review was published in October of 2003 and summarized the importance of investing in technology. Their rationale included: (a) technology could serve as a tool for addressing the challenges in teaching and learning; (b) technology could serve as a change agent and catalyst to solidify the content, methods, and overall quality of the teaching and learning processes; and (c) technology could be a central force in economic competitiveness for our students as well as our country.

These three rationales for investing in educational technology are highly interconnected and require commitment, focus, and resources from a multitude of stakeholders (Culp, Honey, & Mandinach, 2003). Culp et al. (2003) included improving access, connectivity, and infrastructure, creating more high quality content, providing high quality sustained professional development, increasing funding, and defining and promoting the roles of multiple stakeholders as a means to further education technology. The United States Department of Education (2004) through the National Education Technology Plan of 2004 identified strengthening leadership as one way to make effective changes in education. “For public education to benefit from the rapidly
evolving development of information and communication technology, leaders at every level—school, district, and state—must not only supervise but provide informed, creative, and ultimately transformative leadership for systemic change” (United States Department of Education, 2004, p. 39). Byrom and Bingham (2001) identified the leadership administrators bring to the school, as it relates to technology integration as the single most important factor affecting the successful integration of technology into the school.

Public schools have made significant progress expanding internet access to classrooms. Parsad and Jones (2003) found that “by fall 2003, nearly 100% of public schools in the United States had access to the internet compared to 35% in the fall of 1994. Ninety-three percent of instructional classrooms had internet access in 2003 compared to the 3% in 1994” (p. 2). Internet access in public schools has been at or above the 99% range since 1999 and 84% of the teachers surveyed had internet access in their classrooms (Smerdon, Cronen, Lanahan, Anderson, Iannotti, & Angeles, 2000).

The largest group of new users to the internet from 2000 to 2002 was 2- to 5-year-olds (Corporation for Public Broadcasting, 2003). These children are now attending school and sitting in classrooms with computers that have internet access capabilities. Solmon and Wiederhorn (1999) indicated that students spend more than 16% of classroom time using computers and the internet. They also stated that over 80% of students reported being frequent users of technology in the classroom, computer lab, or in library media centers.
The U.S. Department of Education commissioned a survey of these students in 2004. Students voiced their opinions regarding technology. Netday documented these emerging themes:

- Today’s students are tech-savvy, value technology, and depend on technology as an aspect of their everyday life.
- Students approach life and their daily activities differently because of technology.
- As students get older, their use of technology becomes more sophisticated, while younger students will become even greater users of technology. (Netday, 2004, p. 1)

The NetDay (2004) survey revealed 97% of all students surveyed in Grades 7-12, 95% of all students surveyed in Grades 4-6, and 82% of all students surveyed in Grades K-3 believe technology plays a vital role in their education. Students indicated that more technology in schools would allow them to learn more, get better grades, and produce better classroom projects. Considering computers have been in schools for 20 years and most teachers have had some technology professional development, there are still a substantial number of school staff members who are talking the talk but not walking the walk (Byrom & Bingham, 2001).

The Technology Standards for School Administrators asks school leaders to foster a shared vision for the integration of technology, to widely communicate that vision, develop, implement, and monitor long-range systemic technology plans, and to advocate for policies that promote innovative technology and funding for these technologies. The leaders who commit to this comprehensive implementation of technology are undertaking large-scale systemic reform (Technology Standards for School Administrators, 2001). If school administrators are to be successful in integrating technology, they must model effective use of technology, lead technology professional development, lead and manage
the technology systemic change process, and maintain a technology knowledge base (Coughlin & Limke, 1999). This appears to be problematic for administrators as demands on their time continue to increase. Fullan (2001) explained: "The big problems of the day are complex, rife with paradoxes, and dilemmas. For these problems, there are no once-and-for-all answers" (p. 73). There is no dispute over the need for students to have knowledge and competence in our increasingly technology-driven global economy. Our educational system must be reformed and this will require strong leadership (U.S. Department of Education, 2004). However, there appears to be no specific formula for an administrator to maneuver through the complexities of these educational issues and work through these big problems in education.

Purpose of the Study and Research Questions

The purpose of this study was to examine the relationships between the technology competencies of elementary school administrators and the technology integration competencies of teachers under their leadership. Feldner (2003) documented correlations between North Dakota administrator ratings on the Professional Competency Continuum and the technology integration competencies of teachers who worked for them. Feldner (2003) concluded that the ratings of administrators with regard to technology integration competencies are related to teachers' ratings on technology integration competencies.

The following research questions guided this study:

1. What are the relationships between the level of elementary school administrator ratings on the Professional Competency Continuum regarding modeling effective use of technology and the technology integration
competencies of teachers under their leadership for the Professional Competency Continuum V and VI?

2. What are the relationships between the level of elementary school administrator ratings on the Professional Competency Continuum regarding leading professional development and the technology integration competencies of teachers under their leadership for the Professional Competency Continuum V and VI?

3. What are the relationships between the level of elementary school administrator ratings on the Professional Competency Continuum regarding leading and managing systemic change and the technology integration competencies of teachers under their leadership for the Professional Competency Continuum V and VI?

4. What are the relationships between the level of elementary school administrator ratings on the Professional Competency Continuum regarding maintaining a knowledge base and the technology integration competencies of teachers under their leadership for the Professional Competency Continuum V and VI?

Need for the Study

The basis for this study was that school administrators play a critical role in the development and successful implementation of technology integration. Byrom and Bingham (2001) and the United States Department of Education (2004) identified the leadership of administrators as a pivotal factor in leading technology integration in schools. In today's schools, technology directly supports closing the achievement gap,
supporting professional development for school personnel, and providing real-time data systems to inform classroom instructional practices (Lemke, Sayavong, & Martin, 2005). School administrators have been charged with providing a vision for the integration of technology into the mainstream curriculum, providing technology staff development for teachers, managing the systemic changes of technology, and maintaining a contemporary technology knowledge base (Coughlin & Limke, 1999). Considering the rapidly changing technology landscape, additions to the existing literature may contribute to outlining and documenting the necessary technology skills for school administrators so they can foster a shared technology vision in their own schools. This study may document the importance of increased and sustained technology funding to support appropriate technology staff development. Ultimately, it will add to the growing body of literature on the influence of technology leadership.

Feldner (2003) documented a relationship between North Dakota administrator ratings on the Professional Competency Continuum and the technology integration competencies of teachers who worked for them. This study narrowed the focus and attempted to determine if there is significant relationship among elementary school administrators technology competencies and the teachers who work for them now that Phase I, II, and III of ND TWTi is complete. This study may impact how future and current elementary school administrators are trained in modeling the effective use of technology, leading professional development, leading and managing systemic changes in technology, and maintaining a technology knowledge base. It also will be relevant for university educational leadership training programs for future administrators. This study may be of interest to students, parents, and teachers who are interested in advancing
technology in their schools. Administrators and school districts officials may find value in this study as they plan technology staff development and hire administrators, directors of technology, and technology teacher leaders.

Delimitations of the Study

This study was limited to North Dakota elementary school administrators who have completed the Professional Competency Continuum and teachers who have worked for these administrators for 2 or more years. Administrators who serve as an elementary principal and teacher or as a superintendent and elementary principal were included in the elementary principal category. This study was limited to the administrative technology competency areas including modeling effective use, leading professional development, leading and managing systemic change, and maintaining a knowledge base. This study also was limited to the technology integration competencies of teachers which include core technology skills, curriculum, learning, and assessment, classroom instructional practice, and professional practice. These competency areas are identified within the Professional Competency Continuum.

Assumptions

The Professional Competency Continuum is a self-reporting instrument with specific questions and rating scales. It is assumed administrators reported their actual practices and competencies.

The Professional Competency Continuum is a self-reporting instrument with specific questions and rating scales. It is assumed teachers reported their actual practices.

The Professional Competency Continuum is a self-reporting instrument with specific questions and rating scales. It is assumed this instrument is valid and reliable.
and asks questions reflective of necessary technology skills for administrators and teachers.

Definitions of the Terms

**enGauge**: enGauge is a web-based framework for effective technology use which was released in December of 2000. It is a collaborative effort between North Central Regional Educational Laboratory and the METIRI Group. enGauge provides professional development and outlines 21st century technology skills and resources (Burkhardt et al., 2003).

**ISTE (The International Society for Technology Education)**: The International Society for Technology in Education is an international organization with a worldwide membership of leaders in educational technology. Its mission is to “provide leadership and service to improve teaching and learning by advancing the effective use of technology in education” (ISTE, 2000a).

**METIRI Group**: The METIRI Group serves the education community through a broad range of consulting services that empower educators and education institutions to advance effective teaching and learning, use technology in meaningful ways and foster 21st Century Skills in students, teachers, and administrators (Metiri Group, n.d.).

**Milken Foundation on Education Technology**: The Milken Foundation on Technology promotes the effective integration of technology into American schools. It also helps educators and policymakers assess their progress in implementing technology through interactive online tools (Milken Exchange on Education Technology, 1998).

**NCATE (National Council of Accreditation of Teacher Educators)**: The National Council of Accreditation of Teacher Educators is the teaching profession’s mechanism to
help to establish high quality teacher, specialist, and administrator preparation. Through the process of professional accreditation of schools, colleges and departments of education, NCATE works to make a difference in the quality of teaching, teachers, school specialists and administrators. NCATE believes every student deserves a caring, competent and highly qualified teacher (National Council on Accreditation of Teacher Education, n.d.)

ND TWTi (The North Dakota Teaching with Technology Initiative): The North Dakota Teaching with Technology initiative was a statewide program within North Dakota. This 5-year initiative, starting in 1998, provided training and support to public and private educators. This initiative provided professional development for technology integration (Keller, 2001).

NCREL (North Central Regional Educational Laboratory): North Central Regional Educational Laboratory is an organization that specializes in the educational applications of technology. It is a not-for-profit organization dedicated to helping schools and the students they serve reach their full potential (North Central Regional Education Laboratory, n.d.).

North Central Regional Technology in Education Consortium (NCRTEC): A regional technology education consortia funded by the Office of Educational Research and Improvement of the U. S. Department of Education. NCRTEC supported educational technology practices but discontinued operation and existence as of September of 2005.

The Policy and Program Studies Services (PPSS): The Policy and Program Studies Services focuses on education policy analysis and evaluation of programs for the
United States Department of Education. They provide reports, program evaluation, performance measures, and analytic support (United States Department of Education, 2003).

**Professional Competency Continuum (PCC):** The PCC was designed to provide educators with an opportunity to assess their status within the skill and knowledge areas described in the continuum (Coughlin & Lemke, 1999).

**Technology Standards for School Administrators (TSSA):** The Technology Standards for School Administrators is a collaborative effort between national administrative organizations, state departments of education, and national and regional technology laboratories and centers. The TSSA is committed to producing a set of standards necessary for school administrators to ensure effective use of technology in schools (ISTE, 2000a).

**Organization of the Study**

This study is organized in five chapters. Chapter II contains a discussion of the literature related to leadership in modeling effective use of technology, leading technology professional development, leading and managing technology and systemic change and leadership and maintaining a technology knowledge base. Chapter III includes the purpose of the study, the research questions, and the population of the study. Furthermore, Chapter III contains the methods and instrumentation used to conduct the study as well as the facts and figures leading to the analysis of the results. Chapter IV includes the findings of this study in tabular and narrative forms. Finally, Chapter IV includes a discussion of the findings and recommendations for action and further study.

10
CHAPTER II
REVIEW OF LITERATURE

The review of literature will open with a section on modeling the effective use of and maintaining a knowledge base with regard to technology. These are two administrative competency indicators used in the Professional Competency Continuum (PCC) (Lemke & Coughlin, 1999). The first section discusses access to technology in the classroom, student technology standards, teacher technology standards, administrative technology standards, and the digital age. The second section examined technology professional development, which is the third administrative competency indicator used in the PCC (Lemke & Coughlin, 1999). This second section discusses investing in technology, technology use in schools, and types of technology professional development. The third section discusses leading and managing systemic technology change which is the fourth and final administrative competency indicator used in the PCC (Lemke & Coughlin, 1999). The fourth section presents an overview on leadership and reviews leadership, change, and technology as they relate to one another. The North Dakota Teaching with Technology Initiative (ND TWTi) is the fifth and final section. This section discusses the technology integration in North Dakota through ND TWTi and the impact of ND TWTi as it relates to the quantitative data collected through the use of the PCC.
Modeling Effective Use and Maintaining a Knowledge Base

Access to Technology in the Classroom

The advances in technology hardware and software are changing organizations which include educational settings such as public schools (Costello, 1993, 1997; Gurr, 2004; Rivero, 2005). The onset of these technology changes has some questioning our current leadership conceptions and documenting the significant differences between leading and leading technology-mediated environments (Gurr, 2004). Gurr concluded that these new technology environments are inconsistent with each other and filled with dilemmas that stretch leaders to use technology to enhance communication and simultaneously exhibit exceptional interpersonal skills.

Public schools have made significant progress expanding internet access to classrooms. Parsad and Jones (2003) found that “by fall 2003, nearly 100% of public schools in the United States had access to the internet compared to 35% in the fall of 1994. Ninety-three percent of instructional classrooms had internet access in 2003 compared to the 3% in 1994” (p. 2). Internet access in public schools has been at or above the 99% range since 1999 and 84% of the teachers surveyed had internet access in their classrooms (Smerdon et al., 2000).

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The NetDay (2004) survey revealed 97% of all students surveyed in Grades 7-12, 95% of all students surveyed in Grades 4-6, and 82% of all students surveyed in Grades K-3 believe technology plays a vital role in their education. Students indicated that more technology in schools would allow them to learn more, get better grades, and produce better classroom projects (NetDay, 2004). A vast majority of public schools have computers with internet access in their classrooms. The students in these classrooms are depending more and more on technology to meet their academic and social needs. Rivero's (2005) call to action included supporting leadership and systematically developing a technology literate generation of leaders.

*Student Technology Standards*

To be successful in the digital age students will need to attain technology proficiency and be technology literate (Burkhardt et al., 2003). Technology literacy is defined as “the knowledge about what technology is, how it works, what purpose it can serve, and how it can be used efficiently and effectively to achieve specific goals”
(Burkhardt et al., 2003, p. 15). The technology standards outlined by the International Society for Technology in Education (ISTE) developed the National Educational Technology Standards for Students (NETS*S). ISTE outlines six broad categories for student technology capacity. ISTE’s NETS*S framework outlines the fundamental technology skills students need with performance indicators to measure their success (ISTE, 2000b). Burkhardt et al. summarized the NETS*S framework and determined that technology literate students will:

- Demonstrate a sound conceptual understanding of the nature of technology systems and view themselves as proficient users of these systems.
- Understand and model positive, ethical use of technology in both social and personal contexts.
- Use a variety of technology tools in effective ways to increase creative productivity.
- Use communication tools to reach out to the world beyond the classroom and communicate ideas in powerful ways.
- Use technology effectively to access, evaluate, process and synthesize information from a variety of sources.
- Use technology to identify and solve complex problems in real-world contexts. (Burkhardt et al., 2003, p. 22)

There appears to be broad consensus about what students should know and be able to demonstrate to become technology literate.

**Teacher Technology Standards**

ISTE developed the National Educational Technology Standards (NETS) which outlined five standards all classroom teachers should be prepared to meet. These standards include:

- Teachers should be able to demonstrate an understanding of technology operations and concepts.
- Teachers should be able to plan and design effective learning environments and experiences supported by technology.
- Teachers should implement curriculum plans that include methods and strategies for applying technology to maximize student learning.
• Teachers should apply technology to facilitate a variety of effective assessment and evaluations strategies.
• Teachers should use technology to enhance their productivity and professional practices.
• Teachers should understand the social, ethical, legal, and human issues surrounding the use of technology in PK-12 schools and apply that understanding in practice. (ISTE, 2000a, p. 9)

Technology use in today’s classroom is the frontline for improving student learning. If schools provide the professional development so schools can make these changes then:

• Educators must become proficient in the use of technology tools;
• Educators must be skilled in the use of a variety of models of curriculum design and learning strategies supported by technology;
• Educators must develop new organizational and management strategies to support innovative learning in technology-rich environments;
• Educators must use technology to support new, collaborative, professional practices. (Coughlin & Lemke, 1999, p. 7)

Administrative Technology Standards

School administrators have been charged with providing a vision for the integration of technology which includes modeling effective use of technology, leading technology professional development, leading and managing the technology systemic change process, and maintaining a technology knowledge base (Coughlin & Limke, 1999). According to Rivero (2005, p. 32), “nothing is sustainable without leadership understanding the power and potential of embedding technology around and throughout their vision for education.” Tomlinson and Allan (2000) and Senge (1994) both pointed to a shared vision as an essential stepping stone on the pathway of any systemic change process. Pflaum’s (2004) qualitative review of technology use in schools documented the importance of committed school leadership as a common factor for the integration of technology. A framework of standards and performance indicators for school administrators includes:
• Leadership and Vision. Educational leaders inspire a shared vision for comprehensive integrated technology and foster an environment and culture conducive to the realization of that vision.

• Learning and Teaching. Educational leaders ensure that curricular design, instructional strategies, and learning environments integrate appropriate technologies to maximize learning and teaching.

• Productivity and Professional Practice. Educational leaders apply technology to enhance their professional practice and to increase their own productivity and that of others.

• Support, Management, and Operations. Educational leaders ensure the integration of technology to support productive systems for learning and administration.

• Assessment and Evaluation. Educational leaders use technology to plan and implement comprehensive systems of effective assessment and evaluation.

• Social, Legal, and Ethical Issues. Educational leaders understand the social, legal, and ethical issues related to technology and model responsible decision-making related to these issues. (TSSA, 2001, pp. 1-2)

Pully, Sessa, and Malloy (2002) contended that technology is changing at a rapid pace and the confines of leadership must change as well. Waters, Marzano, and McNulty (2004) concluded that if changes are to take place in schools, effective leaders must first look at their own practices. These technology practices will determine an administrator’s vision for the integration of technology. Then, from their own vision, administrators can start the process of establishing a shared vision for the integration of technology which, according to Costello (1997), is an essential first step. Gurr (2004) concluded that if traditional leadership will not suffice in the new technology laden environments that leadership needs to empower those around them to make change. Rivero (2005) contended that leaders at all levels need to be focused on the transformative uses of technology.

The Digital Age

Burkhardt et al. outlined the essential skills for literacy in the digital age. This group attempted to define how children of the 21st Century need to use technology to
make their way within the complexities of digital age. "The solution lies in public acknowledgment that yesterday's education is not sufficient for today's learner. Academic excellence must be acquired within the context of today's technology environment in order to fully prepare students to thrive in the Digital Age" (Burkhardt et al., 2003, p. 4).

The technology available now and the future advances of technology in the digital age will provide students more relevant learning opportunities. These opportunities will allow students to engage in learning in ways that will allow each student reach higher academic achievement levels (Burkhardt et al., 2003). In today's schools, technology directly supports closing the achievement gap, supporting professional development for school personnel, and providing real-time data systems to inform classroom instructional practices (Lemke et al., 2005). Patrick (2003) also called technology a transforming tool that will help organizations gain advantages in the work place and help close the achievement gap that exists within our schools.

Computers have been in schools for 20 years and most teachers have had some technology professional development. However, there still are a substantial number of school staff members who are talking about integrating technology into the curriculum and classroom but have not effectively or efficiently accomplished this endeavor (Byrom & Bingham, 2001). There is no dispute over the need for students to have knowledge and competence in our increasingly technology-driven global economy, and our educational system must be reformed which will require strong leadership (U.S. Department of Education, 2004).
Technology Professional Development

Investing in Technology

In 2003-2004, elementary and secondary schools spent in excess of 500 billion dollars educating students and preparing them for the future (Rivero, 2005; United States Department of Education, 2005). The No Child Left Behind reauthorization of Title II Part D, Enhancing Education Through Technology, distributed in surplus of 600 million dollars to United States schools. These funds were allocated to improve student academic achievement through the use of technology in elementary and secondary schools (Lemke et al., 2005). Although these numbers appear large, Rivero documented three previous stumbling blocks for the integration of technology as the lack of resources, lack of awareness, and failure to understand the complexity of the digital divide that takes place when organizations implement new technologies.

Prior to the National Education Technology Plan of 2004, a comprehensive study of the past 20 years of education technology policy was conducted by the United States Department of Education, Office of Educational Technology. This policy review was published in October of 2003 and summarized the importance of investing in technology. Their rationale included:

- Technology could serve as a tool for addressing the challenges in teaching and learning.
- Technology could serve as a change agent and improve the content, methods, and overall quality of the teaching and learning processes.
- Technology could be a central force in economic competitiveness for our students as well as the United States.
These three rationales for investing in educational technology are highly interconnected and require commitment, focus, and resources from a multitude of stakeholders (Culp et al., 2003). Culp et al. emphasized the importance of providing high quality sustained professional development as a means to further expand education technology.

Coughlin and Lemke outlined the significant pressure educators and entire educational systems are under to change and function in today’s global economy. These changes need to be made to meet the demands of a shifting workforce. Technology use in today’s classroom is the frontline for improving student learning. If professional development is provided, schools can make these changes then:

- Educators must become proficient in the use of technology tools.
- Educators must be skilled in the use of a variety of models of curriculum design and learning strategies supported by technology.
- Educators must develop new organizational and management strategies to support innovative learning in technology-rich environments.
- Educators must use technology to support new, collaborative, professional practices.
- Administrators must be prepared to lead significant change initiatives that support classroom teachers in developing the proficiencies described above. In doing so, they must take an active role in the professional development of all staff under their responsibility. (Coughlin & Lemke, 1999, p. 7)

The second annual National Trends Report commissioned by the State Educational Technology Directors Association (SETDA) and conducted and produced by Lemke et al. (2005) documented seven major findings that support the 600 million dollar Title II Part D spending on an annual basis. These findings included: (a) Strategies are in currently in place to close the achievement gap; (b) leadership appears to be focusing on new types of professional development; (c) states and schools are doing more with less through collaborations and partnerships; (d) the federal formula grants appear to sustain technology while the competitive grants appear to allow schools and districts to
be innovative; (e) states are grappling with evaluation and research; (f) through leadership, a knowledge base is emerging; and (g) in many states, No Child Left Behind Part II D is the only source of funding for technology.

Lemke et al’s. (2005) findings appear to document the significance and emergence of Coughlin and Lemke (1999) research that pointed to the importance of leaders maintaining a knowledge base, providing professional development, and managing change through innovation.

*Technology Use in Schools*

Despite the slow pace of change in education over the past century, education is in a period of change that is rapid and continuous due to the development of information and communication technology (Gurr, 2004). Although there has been an infusion of funding and increased pressure to use technology in schools, the United States Department of Education (2003) indicated that only 55% of teachers reported being frequent users of technology for instructional purposes. Sixty percent of these teachers do not use technology to support multimedia reports or projects, but primarily use technology to improve the computer skills of their students. Teachers have more technology resources today than in any period of history, but do not have the training to maximize the learning potential technology has to offer. Recommendations to improve teacher training include ensuring teachers understand how data can be used to drive instruction, assist in decision making, and ultimately use data to meet the specific needs of every child (United States Department of Education, 2004).
Types of Technology Professional Development

There are indicators of positive associations between the amount and type of technology professional development and the use of educational technology within classrooms that include:

- The greater the number of technology-related professional development activities teachers engaged in, the more likely they were to be frequent users of technology for instructional purposes (even after controlling for a variety of other factors that predict technology use such as teacher age, computer viability, several other characteristics, etc.). The same result also held for professional (non-instructional) uses of technology.
- The majority of teachers indicated that the professional development activities they engaged in prepared them to use educational technology in teaching. Among teachers engaging in within-district workshops, the most common formal professional development activities, only 5% said the activity did not prepare them at all to use educational technology in teaching and 64% said it prepared them to a moderate or great extent.
- Teachers whose professional development was more focused on integration into instruction were significantly more likely to report being more frequent users of technology for instructional purposes, even after controlling for a variety of other factors that predict technology use (e.g., teacher age, the number of professional development activities, computer availability, several school characteristics, etc.). (United States Department of Education 2003, pp. 15-16)

The professional development provided to teachers needs to utilize the differentiated instructional approaches that work with students. Teachers’ technology skills start at the entry level, then move to the adaptation and innovation levels, and finally end with teachers using technology at the transformation level. The professional development activities for teachers need to include how technology can support the current curriculum, how technology serves as an instructional tool, and devising time for teachers to plan for these integration activities (Pitler, 2006). Pitler contended that “if schools add technology without providing adequate professional development the only thing that will increase is their electric bill” (Pitler, 2006, p. 39). Sparks and Hirsh (1997)
documented the central role staff development plays in the reform efforts of today's schools. If schools are to improve the academic achievement levels of their students, then the staff development necessary to accomplish this task must be the responsibility of everyone.

Byrom and Bringham documented the outcomes of schools that received intensive technology technical and professional development. This intensive support included 3 to 4 days a month when teachers and administrators were provided with professional development on technology integration. This intensive 5-year process yielded the follow lessons:

- Leadership is the key ingredient.
- If you don’t know where you are going, you’re likely to wind up somewhere else.
- Technology integration is a slow process.
- No matter how many computers are available or how much training teachers have had, there are still substantial numbers who are talking the talk but not walking the walk.
- Effective use of technology requires changes in teaching; in turn, the adoption of a new teaching strategy can be a catalyst for technology integrations.
- Each school needs easy access to professionals with expertise in technology and pedagogy.
- Barriers to using technology to support learning are the same for all poor communities, but some populations have additional issues.
- Evaluation is often the weakest element of technology programs. (Byrom & Bringham, 2001, p. 23)

The results of this long-term project in resource-poor schools shed light on the importance of leadership and professional development that is focused on changing the way teachers teach and administrators lead. Sparks and Hirsh (1997) appeared to concur with Byrom and Bingham (2001) as all four authors documented the importance of staff development that provides a wide variety of learning opportunities for both teachers and administrators.
Leading and Managing Systemic Technology Change

Transformational Leadership Summary

Throughout the centuries leadership has been linked to the effective and efficient functioning of organizations (Marzano, Waters, & McNulty, 2005). It is well documented that leadership plays a crucial part in a schools attempt at improving teaching and learning, but what makes an effective and efficient leader remains vague (Day, 2000a). Scheive and Schoenheit (1987) actually wrote an entire book about examining leadership titled *Leadership: Examining the Elusive*. The theories on leadership abound and many new theories are rooted in the early works of James McGregor Burns (Day, 2000a; Marzano et al., 2005).

The two terms many researchers use when discussing leadership are transformational and transactional leadership (Marzano et al., 2005). These terms first came from James McGregor Burns in 1978. He used the word transforming instead of the more recent term transformational. Burns defined leadership in general as:

I define leadership as leaders inducing followers to act for certain goals that represent the values and the motivations—the wants and needs, the aspirations and expectations—of both leaders and followers. And the genius of leadership lies in the manner in which leaders see and act on their followers’ values and motivations. (Burns, 1978, p. 19)

Burns (1978) concluded the relationship between leader and follower is crucial; however, it takes two fundamentally different forms with one being transforming and the other transactional. Transformational and transactional leadership relationships share common ground in that motives, values, and goals of the leader and those being led have emerged during either of the leadership forms.
Transactional leadership is the exchange of one thing of value for another thing of value. The transactional process recognizes that the relationship exists during the transaction but each side does not have an enduring purpose to hold the relationship together (Burns, 1978). Marzano et al. (2005) defined transactional as quid pro quo or simply exchanging one thing for another. Bass and Avolio (1994) contended that there are three distinct structures of transactional leadership. Management by exception passive is characterized by leaders waiting for problems to arise before they take any action. The second type of transactional leadership includes management by exception active where the leader reinforces procedures and monitors followers to ensure a set of standards and to avoid mistakes. The final type of transactional leadership includes constructive transactional. This type of leadership is characterized by the leader exchanging rewards and promises for effort or job performance.

Transformational or transforming as it is referred to by Burns (1978) occurs when a person or people engage others in a way that both parties are raised to higher levels of motivation and morality. Marzano et al. (2005) simply defined transformational as leadership that focuses on the change process. An example of transformational leadership can be seen in the life work of Gandhi who worked with his nation's people to hope for and demand more out of life, for the good of all people. While he did this his status was elevated during the process (Burns, 1978). When transformational leadership is used effectively, leaders and followers are united in the process, but it is the leader who initiates the process, creates the conditions for communication and exchange of ideas, skillfully evaluates motives, and anticipates responses (Burns, 1978). Epitropaki (2001) contended that transformational leadership can be taught to new leaders and it is not a
quality only a few people possess. Epitropaki summarized transformational leadership as:

Transformational leadership is a form of leadership that occurs when leaders broaden and elevate the interests of their employees. Transformational leaders have a clear collective vision and most importantly they manage to communicate it effectively to all employees. By acting as role models, they inspire employees to put the good of the whole organization above self interest. They also stimulate employees to be more innovative, and they themselves take personal risks and are not afraid to use unconventional but always 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 mainly 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 breathe and grow. In that respect, transformational is a more developmental and constructive form of leadership for both employees and the organization as a whole. (Epitropaki, 2001, p. 1)

Day (2000a) documented recent trends in leadership and linked new educational terms such as liberation, educative, invitational, and moral leadership with Burns’ (1978) transformational leadership theory. Day (2000a) asserted that what makes an effective or successful leader is difficult to pinpoint. However, leaders who stick to their values in divisive situations can inspire others to follow which in turn serves the good of the school. Day (2000b) further asserted that the literature on effective principals suggests that effective principals are transformative rather than transactional. However, Day (2000b) concluded that systematic reflection is necessary if principals are going to be effective.

The importance of values and the implications of the change process resonate throughout the transformational leadership philosophy (Burns, 1978). The leaders who prescribe to the transformational leadership teachings know the importance of
establishing a set of common values that will ultimately build a sense of community (Sergiovanni, 1996). The notion of common organizational values and their positive impact is well documented (DuFour & Eaker, 1998; Niven, 2006; Senge, 2004; Sergiovanni, 1996). These common organizational values need to be the deeply held beliefs of everyone in the organization (Senge, 1994). When this happens, beliefs and values become a shared purpose. When organizations and leaders start the process of establishing these shared values, both parties will have to engage each other in ways that raise each other's motivation and morality (Burns, 1978). The complexities of this change process are what Fullan (2001) referred to as the big problems of the day. Fullan (2001) explained: "The big problems of the day are complex, rife with paradoxes and dilemmas. For these problems, there are no once-and-for-all answers" (Fullan, 2001, p. 73).

Leadership, Change, and Technology

The EDvancenet consortium created a guide for leaders which outlines important factors leaders must understand in order to support the educational goals of the new age of information technology. These 12e goals are intended to help students flourish, inform instructional practices, and ultimately assist students in learning. These 12 keys for success include:

- Integrate technology into long-range educational improvement plans.
- Prioritize spending and provide funding.
- Involve the community and gain their support.
- Acknowledge equity issues when planning for technology acquisition.
- Articulate the role of technology in the overall educational program.
- Require the adoption of long-term professional development plans that involve technology.
- Encourage the development of quality content based on standards.
- Conduct community-wide, ongoing forums.
- Nurture partnerships with other organizations to support change.
• Determine how the school or district will measure the success of technology use.
• Commit to reassess and revise your school improvement plans regularly.
• Celebrate the accomplishments of technology in your schools. (Edvancenet, 1998, p. 17)

Fulton (1998) concluded 8 years ago that technology provides opportunities for both teaching and learning that could be used to improve our educational system. The value of administrative support and leadership is critical if technology is to be successfully integrated. The building principal needs to be seen using technology, openly supporting technology as a part of instruction and learning, and even leading the technology staff development within buildings. The administrator needs the support and the involvement of teachers if the technology is going to impact student achievement (Pitler, 2006).

According to Valdez (2004), educational leaders are expected to use instructional technology to enhance the educational process. These expectations are based on students needing to function in an informational global society that embraces immediate access in almost all work areas. School leaders also have been tapped to use technology to make education more effective and efficient while ensuring students are technology literate. Schools that make the most of the available technology have strong leaders and focus their technology resources (Pflaum, 2004).

The United States Department of Education, through the National Education Technology Plan of 2004, identified strengthening leadership as one way to make effective changes in education. “For public education to benefit from the rapidly evolving development of information and communication technology, leaders at every level—school, district, and state—must not only supervise but provide informed, creative, and ultimately transformative leadership for systemic change” (United States

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Department of Education, 2004, p. 39). Marzano et al.’s meta-analysis of school leadership as practiced by principals identified 21 different responsibilities that have an effect on student achievement which included:

- Serving as a change agent who is willing to challenge the status quo.
- Providing a focus by establishing clear goals that everyone understands and works toward.
- Being an optimizer by leading new and challenging innovations.
- Being an active participant in the design and implementation of curriculum, instruction, and assessment.
- Maintaining order by establishing procedures and routines.
- Monitoring and evaluating school practices that impact student learning.
  (Marzano et al., 2005, pp. 42-43)

Change is the factor that impacts all of these administrative responsibilities. However, when change includes departing from past comfortable procedures and processes, administrators must understand the importance of leading the new innovations, be knowledgeable of curriculum, instruction, and assessment, and understand the change process (Marzano et al., 2005). Changes in educational technology are happening at a rapid pace and (Lanahan, 2002; Rivero, 2005) the single most important factor affecting the successful integration of technology into the school is the leadership of the school administrator (Byrom & Bingham, 2001).

An effective administrator makes a significant impact on whether technology will be used to positively influence educational productivity of a school (Valdez, 2004). “School leaders are expected to be both participants in and agents of change in their school organizations as they respond to the increasingly complex and chaotic changes in the external environment, including new standards for student learning and performance and the rapid pace of technological changes” (Valdez, 2004, p. 7). It is Wheatley (1999) who insisted that the chaotic nature of the organization we work in needs to be embraced
by leaders. These leaders need to understand the difference between order and control within the change process. Fullan (2001) similarly concluded that change is not a totally predictable process but rather a process that is full of complexities and contradictions. “Change cannot be managed. It can be understood and perhaps led but it cannot be controlled” (p. 33-34). The leadership that is provided during the change process does make a difference (Fullan, 2001).

The five characteristics of effective transformational leaders who focused on ensuring constructive change included:

- A strong sense of moral purpose.
- An understanding of the dynamics of change.
- An emotional intelligence as they build relationships.
- A commitment to developing and sharing new knowledge.
- A capacity for coherence making. (Fullan, 2001, p. 15)

The administrator in the 21st Century will use technology to enhance the perfunctory day-to-day activities of management. Some of these same administrators will ultimately use the tools and processes technology has to offer to be more creative and dynamic with the information available to them via the technology (TSSA, 2001). The ability to equip teachers and leaders with an accountability system that documents meaningful and constructive data driven decisions in the school can transform the education we provide for everyone. The leaders of educational systems must provide a focus for the entire school and make decisions based on information that will improve student achievement (Reeves, 2005). If large scale reform is to take place in schools and within districts, then sustainability of the reform is the most critical element and, in order to ensure sustainability of the reform effort, leadership is essential (Fullan, 2005).
North Dakota Teaching with Technology Initiative (TWTi)

Technology Integration in North Dakota

The North Dakota Teaching with Technology initiative (ND TWTi) provided technology training and on-site technical assistance to all North Dakota public and private K-12 teachers and administrators to effectively integrate technology into the existing curriculum (Technology Innovation Challenge Grant Program Performance Report, 2001). This 5-year state-wide program was initially funded in 1998. ND TWTi was delivered in three professional development phases and was based on the National Council of Accreditation of Teacher Educators (NCATE) and the International Society for Technology Education (ISTE) standards. The primary goal of ND TWTi was to move North Dakota teachers and administrators toward transformation on the Professional Competency Continuum (PCC) by providing professional development to better integrate technology (Technology Innovation Challenge Grant Program Performance Report, 2001). The PCC measures the technology behaviors of teachers and administrators in relation to the national technology standards (Coughlin & Lemke, 1999). The PCC was developed as a joint project between the Milken Exchange and the North Central Regional Education Laboratory (NCREL) with input from a number of educational experts (Coughlin, 1999; Coughlin & Lemke, 1999; Technology Innovation Challenge Grant Program Performance Report, 2001). The PCC identified five key target areas for improving educational technology which include core technology skills, curriculum, learning and assessment, professional practices, classroom and instructional management, and administrative competencies. The respondent answers questions in each competency area; the responses determine level of placement on a continuum. The

30
continuum is based on the “stages of instructional evolution” identified in the research from Apple Classrooms of Tomorrow program (Coughlin & Lemke, 1999).

The PCC continuum stages range from Entry to Adaptation to Transformation. At the Entry stage, educators, students, and community members are aware of the possibilities that technology holds for improving learning but, learning, teaching, and the system remain relatively unchanged. Educators at this level lack access to technology and the necessary skills to implement and sustain significant changes to their instructional practices (Coughlin & Lemke, 1999). The Adaptation stage is where technology is thoroughly 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 processes already in place (Coughlin & Lemke, 1999). The Transformational stage is where 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 creative application of technology to the entire school community (Coughlin & Lemke, 1999).

The teacher survey instrument has 65 questions that relate to 22 technology indicators. Each indicator is aligned to one of four competency areas that include Core Technology Skills, Curriculum Learning, and Assessment, Professional Practice, and Classroom and Instructional Management. The PCC respondents receive a mean score for each competency area and an overall mean score which is calculated from the mean of the four competency areas (Technology Innovation Challenge Grant Program Performance Report, 2001).
The administrative survey instrument has 64 questions that relate to 18 technology indicators. Each indicator is aligned to one of three competency areas. The PCC respondent receives a mean score for each competency area and an overall mean score which is calculated from the mean of the three competency areas (Lemke & Coughlin, 1998). The three administrative competency areas include Core Technology Skills, Professional Practice, and Administrative Competency.

Phase I of ND TWTi was completed in May of 2001 and had 9,120 participants which equates to 89% of all certified full-time and part-time North Dakota educators (Technology Innovation Challenge Grant Program Performance Report, 2001). This phase consisted of a classroom educator’s strand and an administrative strand. During this Phase, classroom educators redesigned a lesson that integrated the use of technology to enhance the teaching and learning process. The administrative strand focused on increasing their knowledge base related to technology integration and also worked on modeling the effective use of technology (Technology Innovation Challenge Grant Program Performance Report, 2001).

Phase II of ND TWTi was completed in January of 2003 and had 6,065 participants. This phase also had a classroom educator’s strand and a leadership strand. The classroom educator’s strand focused on teaching and learning strategies that would engage students in project-based learning, problem-based learning, and inquiry-based learning. All of these learning strategies would incorporate the use of technology to engage students to work on authentic educational tasks. The leadership strand partnered participating building administrators with a mentor (Technology Innovation Challenge Grant Program Performance Report, 2001). The leadership participants focused on
technology integration processes in their own schools and districts. The leaders directed the change initiatives that supported their teachers' new technology teaching and learning strategies (Technology Innovation Challenge Grant Program Performance Report, 2001).

Phase III was the final phase of ND TWTi which was completed in August of 2005. The participants in Phase III self-directed much of their own experiences which required collective collaboration (Kincaid, 2005; Technology Innovation Challenge Grant Program Performance Report, 2001). The curriculum for this phase ended up being completely on-line while educational and technical support was provided by the building-base leadership that was formalized in Phase II (Kincaid, 2005). All Phase III participants were expected to be contributors to the current technology knowledge base while students were expected to be explorers, teachers, cognitive apprentices, and directors of their own learning. Teachers would primarily serve as facilitators and co-learners of authentic and challenging learning tasks (Technology Innovation Challenge Grant Program Performance Report, 2001). The leadership strand continued the efforts started in Phase II of implementing technology change initiatives. Leaders would formalize these initiatives through building level and district level professional development plans then support these plans through formal and informal evaluation plans (Technology Innovation Challenge Grant Program Performance Report, 2001).

In summary, ND TWTi provided support necessary to implement the state network and digital video. The ND TWTi documented the need for buildings to invest in additional technology for use by all educators and students. This initiative allowed schools to work toward a collaborative process to improve the technology integration
capacities and use the evidence collected as a measure for continued improvement (Kincaid, 2005).

Impact of TWTi in North Dakota

Feldner (2003) documented a relationship between North Dakota administrator ratings on the Professional Competency Continuum and the technology integration competencies of teachers who worked for them. Feldner used the administrative competencies which included (a) modeling effective use, (b) leading professional development, (c) leading and managing systemic change, and (d) maintaining a knowledge base. Feldner compared these administrative competencies to the technology integration competencies of teachers which included (a) core technology skills; (b) curriculum, learning, and assessment; (c) professional practices; and (d) classroom and instructional management (Coughlin & Lemke, 1999). The study indicated that with the exception of 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 beyond the .001 level (Feldner, 2003). Feldner concluded “it appears that the rating of administrators with regard to technology integration competencies are related to teachers’ ratings on technology integration competencies” (Feldner, 2003, p. 86).
CHAPTER III
THE PURPOSE OF THE STUDY

The purpose of this study was to examine the relationships between the technology competencies of elementary school administrators and the technology integration competencies of teachers under their leadership. Feldner (2003) documented correlations between North Dakota administrator ratings on the Professional Competency Continuum and the technology integration competencies of teachers who worked for them. Feldner (2003) concluded that the ratings of administrators with regard to technology integration competencies are related to teachers' ratings on technology integration competencies.

The following questions were used to guide this study:

1. What are the relationships between the level of elementary school administrator ratings on the Professional Competency Continuum regarding modeling effective use of technology and the technology integration competencies of teachers under their leadership for the Professional Competency Continuum V and VI?

2. What are the relationships between the level of elementary school administrator ratings on the Professional Competency Continuum regarding leading professional development and the technology integration
competencies of teachers under their leadership for the Professional Competency Continuum V and VI?

3. What are the relationships between the level of elementary school administrator ratings on the Professional Competency Continuum regarding leading and managing systemic change and the technology integration competencies of teachers under their leadership for the Professional Competency Continuum V and VI?

4. What are the relationships between the level of elementary school administrator ratings on the Professional Competency Continuum regarding maintaining a knowledge base and the technology integration competencies of teachers under their leadership for the Professional Competency Continuum V and VI?

Research Population

The sample for this study consisted of kindergarten through sixth-grade teachers in North Dakota's public and private schools. This study included North Dakota elementary teachers who have worked for the same administrator for 2 or more years. This study also included elementary administrators in North Dakota public and private schools who have rated themselves at the entry, adaptive, and transformation stage on the Professional Competency Continuum. Administrators who served as elementary principals and teachers or as superintendents and elementary principals were included in the elementary principal category. The Professional Competency Continuum V and VI were used as these data were the latest available.
Survey Instrument

*Professional Competency Continuum*

The data collection tool was the Professional Competency Continuum (PCC) profile assessment. The data from this survey was preexisting and spanned from 1999 to 2006. The PCC was a part of the North Dakota Teaching with Technology initiative (ND TWTi). ND TWTi provided technology training and support to North Dakota teachers and administrators. The PCC measured the technology competencies of teachers and administrators in relation to the national technology standards (Coughlin & Lemke, 1999). The PCC was developed as a joint project between the Milken Exchange and the North Central Regional Education Laboratory (NCREL) with input from a number of educational experts (Coughlin, 1999; Coughlin & Lemke, 1999; Technology Innovation Challenge Grant Program Performance Report, 2001). The PCC identified five key areas for improving educational technology which included core technology skills, curriculum, learning and assessment, professional practices, classroom and instructional management, and administrative competencies. Each competency area allowed the respondent to answer questions which then placed the respondent on a continuum. The continuum was based on the “stages of instructional evolution” identified in the research from Apple Classrooms of Tomorrow program (Coughlin & Lemke, 1999, p. 11).

The continuum stages are Entry, Adaptation, and Transformation. The continuum ranged from 1 to 10 with 1 being low and 10 being high. The Entry stage scores ranged from 1 through 3, Adaptation stage ranged from 4 through 7, and Transformational stage ranged from 8 through 10. At the Entry stage (1-3), educators, students, and community members are aware of the possibilities that technology holds for improving learning but,
learning, teaching and the system remain relatively unchanged. Educators at this stage lack access to technology and the necessary skills to implement and sustain significant changes to their instructional practices (Coughlin & Lemke, 1999). The Adaptation stage (4-7) is where technology is thoroughly 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 processes already in place (Coughlin & Lemke, 1999). The Transformational stage (8-10) is where 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 creative application of technology to the entire school community (Coughlin & Lemke, 1999).

The teacher PCC survey instrument has 65 questions that relate to 22 technology indicators. Each indicator is aligned to one of four competency areas that include core technology skills, curriculum learning, and assessment, professional practice, and classroom and instructional management. The PCC respondents receive a mean score for each competency area and an overall mean score which is calculated from the mean of the four competency areas (Technology Innovation Challenge Grant Program Performance Report, 2001).

Table 1 illustrates the relationships between questions, indicators, and competencies on the teacher PCC survey instrument.
Table 1. Technology Indicators and Number of Questions per Indicator Grouped by Teacher Competencies from the Professional Competency Continuum.

<table>
<thead>
<tr>
<th>PCC Competencies</th>
<th>Indicators Used to Derive PCC Competencies</th>
<th>Number of Questions per Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core Technology Skills</td>
<td>Hardware/Computers</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Hardware/Other</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Applications</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Information Tools</td>
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<tr>
<td></td>
<td>Network Tools</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Multimedia/Presentation Tools</td>
<td>4</td>
</tr>
<tr>
<td>Curriculum, Learning, and Assessment</td>
<td>Curriculum Design</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Teaching/Learning Strategies</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>New Roles for Educators</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>New Roles for Students</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Assessment</td>
<td>4</td>
</tr>
<tr>
<td>Professional Practice</td>
<td>Uses of Technology for Personal Productivity</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Professional Collaboration</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Communication to/with Stakeholders</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Professional Growth</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Community Outreach</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Ethical Use</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Professional Resources</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Resource Acquisition</td>
<td>1</td>
</tr>
<tr>
<td>Classroom and Instructional Management</td>
<td>Organization and Use</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Access and Location</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Instructional Management</td>
<td>3</td>
</tr>
</tbody>
</table>

The administrative PCC survey instrument had 64 questions that related to 18 technology indicators. Each indicator was aligned to one of three competency areas. The PCC respondent received a mean score for each competency area and an overall mean.
score which was calculated from the mean of the three competency areas (Lemke &
Coughlin, 1998). The three administrative competency areas included Core Technology
Skills, Professional Practice, and Administrative Competency.

Table 2 illustrates the relationships between questions, indicators, and
competencies on the administrative PCC survey instrument.

Table 2. Technology Indicators and Number of Questions per Indicator Grouped by
Administrator Competencies from the Professional Competency Continuum.

<table>
<thead>
<tr>
<th>Administrator PCC Competencies</th>
<th>Indicators Used to Derive PCC Competencies</th>
<th>Number of Questions per Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core Technology Skills</td>
<td>Hardware/Computers</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Hardware/Other</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Applications</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Information Tools</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Network Tools</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Multimedia/Presentation Tools</td>
<td>4</td>
</tr>
<tr>
<td>Professional Practice</td>
<td>Uses of Technology for Personal Productivity</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Professional Collaboration</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Communication to/with Stakeholders</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Professional Growth</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Community Outreach</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Ethical Use</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Professional Resources</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Resource Acquisition</td>
<td>1</td>
</tr>
<tr>
<td>Administrative Competency</td>
<td>Modeling Effective Use</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Leading Professional Development</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Leading and Managing Systemic Change</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Maintaining a Knowledge Base</td>
<td>5</td>
</tr>
</tbody>
</table>
Data Collection Procedures

The North Dakota Teaching with Technology Initiative held all the data from the Professional Competency Continuum surveys completed in the last 7 years. This initiative was a 7-year grant project which has since been completed. Dr. Tanna Kincaid, Technology Director for Bismarck Public Schools, was the Director of North Dakota Teaching with Technology Initiative and continues to house all data related to the North Dakota teacher and administrator Professional Competency Continuum. A letter to Dr. Tanna Kincaid requesting permission to use the data was submitted and approval to use the Professional Competency Continuum data was granted (Appendices B & C). The data eliminated names and did not use categories that had less than five respondents. The data were downloaded electronically and analyzed using Microsoft Excel and the Statistical Package for the Social Sciences (SPSS) computer software.

Statistical Treatment of Data

This study analyzed paired sample populations of administrators and teachers from PCC V and VI. From these paired samples, mean values and standard deviations were calculated and demographic data were collected. The data were analyzed for relationships between the administrator technology competency ratings and the technology integration competency ratings of teachers. Research questions 1-4 were tested using the Pearson Product-Moment Correlation Coefficient. Correlations between each indicator from the administrator competencies and the technology integration competencies of teachers were tested for significance. The data in this study were used to determine correlations between elementary school administrators and the technology integration competencies of teachers under their leadership for 2 or more years.
In Chapter IV, the researcher has presented the data and its analysis in tabular and narrative forms.
CHAPTER IV
ANALYSIS OF THE DATA

The data in this study were used to determine the technology behavior relationships between elementary school administrators and the technology integration skills of teachers under their leadership. This study included data related to:

- The relationships between the level of elementary school administrator ratings on the Professional Competency Continuum regarding modeling effective use of technology and the technology integration competencies of teachers under their leadership for the Professional Competency Continuum V and VI.

- The relationships between the level of elementary school administrator ratings on the Professional Competency Continuum regarding leading professional development and the technology integration competencies of teachers under their leadership for the Professional Competency Continuum V and VI.

- The relationships between the level of elementary school administrator ratings on the Professional Competency Continuum regarding leading and managing systemic change and the technology integration competencies of teachers under their leadership for the Professional Competency Continuum V and VI.

- The relationships between the level of elementary school administrator ratings on the Professional Competency Continuum regarding maintaining a
knowledge base and the technology integration competencies of teachers under their leadership for the Professional Competency Continuum V and VI.

The participants included 1,457 teachers of whom 1,293 (88.7%) were female and 164 (11.3%) were male; in addition, there were 226 administrators, with 100 (44.2%) females and 126 (55.8%) males. The PCC instrument collects demographic data that divides North Dakota into eight regions. These regions include the areas around Williston, Minot, Devils Lake, Grand Forks, Fargo, Valley City, Bismarck, and Dickinson. Administrator participation included a frequency range from a low of 19 participants in the Grand Forks area to a high of 30 participants in the Minot area. Teacher participation included a frequency range from a low of 105 in the Grand Forks area to a high of 200 in the Fargo area.

The data were grouped by school building which paired administrators with teachers who worked for them for 2 or more years. The PCC V and IV identified 146 school buildings where administrators and teachers completed all sections of the PCC. The PCC V also identified an additional 29 buildings where administrators completed the entire PCC and teachers completed the core technology skills and professional practices sections. This additional data increased total identified school buildings to 175 for the core technology skills and professional practices sections of PCC V.
Table 3. Demographic Data from the Administrator and Teacher Professional Competency Continuum V and VI.

<table>
<thead>
<tr>
<th>Number of Elementary Administrators</th>
<th>FEMALE Frequency</th>
<th>Percentage</th>
<th>MALE Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Elementary Administrators</td>
<td>100</td>
<td>44.2</td>
<td>126</td>
<td>55.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Educational Level of Administrators</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Associates degree</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bachelors degree</td>
<td>84</td>
<td>37.2</td>
</tr>
<tr>
<td>Masters degree</td>
<td>119</td>
<td>52.7</td>
</tr>
<tr>
<td>Doctorate degree</td>
<td>10</td>
<td>4.4</td>
</tr>
<tr>
<td>Other</td>
<td>13</td>
<td>5.8</td>
</tr>
<tr>
<td>Total</td>
<td>226</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Elementary Teachers</th>
<th>FEMALE Frequency</th>
<th>Percentage</th>
<th>MALE Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Teachers</td>
<td>1293</td>
<td>88.7</td>
<td>164</td>
<td>11.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Educational Level of Teachers</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Associates degree</td>
<td>6</td>
<td>0.4</td>
</tr>
<tr>
<td>Bachelors degree</td>
<td>881</td>
<td>60.5</td>
</tr>
<tr>
<td>Masters degree</td>
<td>562</td>
<td>38.6</td>
</tr>
<tr>
<td>Doctorate degree</td>
<td>2</td>
<td>0.1</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
<td>0.4</td>
</tr>
<tr>
<td>Total</td>
<td>1457</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Administrators Total Number of Years in Education</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 6</td>
<td>7</td>
<td>2.9</td>
</tr>
<tr>
<td>6 - 10</td>
<td>14</td>
<td>6.2</td>
</tr>
<tr>
<td>11 - 20</td>
<td>78</td>
<td>34.6</td>
</tr>
<tr>
<td>21 - 30</td>
<td>71</td>
<td>31.5</td>
</tr>
<tr>
<td>Over 30</td>
<td>56</td>
<td>24.8</td>
</tr>
<tr>
<td>Total</td>
<td>226</td>
<td>100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Teacher Total Number of Years in Education</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 6</td>
<td>129</td>
<td>5.4</td>
</tr>
<tr>
<td>6 - 10</td>
<td>184</td>
<td>12.5</td>
</tr>
<tr>
<td>11 - 20</td>
<td>395</td>
<td>27.2</td>
</tr>
<tr>
<td>21 - 30</td>
<td>522</td>
<td>35.8</td>
</tr>
<tr>
<td>Over 30</td>
<td>227</td>
<td>15.7</td>
</tr>
<tr>
<td>Total</td>
<td>1457</td>
<td>100</td>
</tr>
</tbody>
</table>
Table 3. Continued.

<table>
<thead>
<tr>
<th>Administrator Distribution by Region</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region 1 - Williston</td>
<td>24</td>
<td>12.9</td>
</tr>
<tr>
<td>Region 2 - Minot</td>
<td>30</td>
<td>16.1</td>
</tr>
<tr>
<td>Region 3 - Devils Lake</td>
<td>25</td>
<td>13.4</td>
</tr>
<tr>
<td>Region 4 - Grand Forks</td>
<td>19</td>
<td>10.2</td>
</tr>
<tr>
<td>Region 5 - Fargo</td>
<td>20</td>
<td>10.8</td>
</tr>
<tr>
<td>Region 6 - Valley City</td>
<td>22</td>
<td>11.8</td>
</tr>
<tr>
<td>Region 7 - Bismarck</td>
<td>24</td>
<td>12.9</td>
</tr>
<tr>
<td>Region 8 - Dickinson</td>
<td>22</td>
<td>11.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Teacher Distribution by Region</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region 1 - Williston</td>
<td>116</td>
<td>9.7</td>
</tr>
<tr>
<td>Region 2 - Minot</td>
<td>157</td>
<td>13.1</td>
</tr>
<tr>
<td>Region 3 - Devils Lake</td>
<td>169</td>
<td>14.1</td>
</tr>
<tr>
<td>Region 4 - Grand Forks</td>
<td>105</td>
<td>8.8</td>
</tr>
<tr>
<td>Region 5 - Fargo</td>
<td>200</td>
<td>16.7</td>
</tr>
<tr>
<td>Region 6 - Valley City</td>
<td>111</td>
<td>9.3</td>
</tr>
<tr>
<td>Region 7 - Bismarck</td>
<td>199</td>
<td>16.6</td>
</tr>
<tr>
<td>Region 8 - Dickinson</td>
<td>139</td>
<td>11.6</td>
</tr>
</tbody>
</table>

Administrators who completed the Professional Competency Continuum V and VI rated their technology integration competencies on a 10-point scale, with 10 being high. Administrators, who rated themselves as 1, 2, or 3, were categorized in the Entry stage, those who rated themselves as 4, 5, 6, or 7 were categorized in Adaptive stage, and those who rated themselves as 8, 9, or 10 were categorized in the Transformation stage.

Table 4 presents the mean and standard deviations for the administrative technology competency areas. The data are presented in the order they appeared in the assessment for administrators who completed the Professional Competency Continuum V.
Table 4. Mean and Standard Deviation of Administrator Ratings of Administrative Competencies on the Professional Competency Continuum V.

<table>
<thead>
<tr>
<th>Administrative Competencies</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modeling Effective Use</td>
<td>175</td>
<td>7.74</td>
<td>1.19</td>
</tr>
<tr>
<td>Leading Professional Development</td>
<td>175</td>
<td>7.40</td>
<td>1.24</td>
</tr>
<tr>
<td>Leading and Managing Systemic Change</td>
<td>175</td>
<td>6.96</td>
<td>1.47</td>
</tr>
<tr>
<td>Maintaining a Knowledge Base</td>
<td>175</td>
<td>7.04</td>
<td>1.34</td>
</tr>
</tbody>
</table>

The mean rating for administrators in PCC V for Modeling Effective Use was 7.74, the mean rating for administrators in PCC V for Leading Professional Development was 7.40, the mean rating for administrators in PCC V for Leading and Managing Systemic Change was 6.96, and the mean rating for administrators in PCC V for Maintaining a Knowledge Base was 7.04. All mean scores for elementary administrators on the PCC V fall in the Adaptive range (4-7).

Table 5 presents the mean and standard deviations for the administrative technology competency areas. The data are presented in the order they appeared in the assessment for administrators who completed the Professional Competency Continuum VI.

Table 5. Mean and Standard Deviation of Administrator Ratings of Administrative Competencies on the Professional Competency Continuum VI.

<table>
<thead>
<tr>
<th>Administrative Competencies</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modeling Effective Use</td>
<td>146</td>
<td>7.72</td>
<td>1.13</td>
</tr>
<tr>
<td>Leading Professional Development</td>
<td>146</td>
<td>7.49</td>
<td>1.16</td>
</tr>
<tr>
<td>Leading and Managing Systemic Change</td>
<td>146</td>
<td>7.01</td>
<td>1.41</td>
</tr>
<tr>
<td>Maintaining a Knowledge Base</td>
<td>146</td>
<td>7.05</td>
<td>1.29</td>
</tr>
</tbody>
</table>

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The mean rating for administrators in PCC VI for Modeling Effective Use was 7.72, the mean rating for administrators in PCC VI for Leading Professional Development was 7.49, the mean rating for administrators in PCC VI for Leading and Managing Systemic Change was 7.01, and the mean rating for administrators in PCC VI for Maintaining a Knowledge Base was 7.05. The mean scores for administrators from PCC V to PCC VI all increased with the exception of Modeling Effective Use which decreased from PCC V to PCC VI. All mean scores for elementary administrators on the PCC VI fall in the Adaptive range (4-7).

Teachers who completed the Professional Competency Continuum V and VI rated their technology integration competencies on a 10-point scale, with 10 being high. Teachers, who rated themselves as 1, 2, or 3, were categorized in the Entry stage, those who rated themselves as 4, 5, 6, or 7 were categorized in the Adaptive stage, and those who rated themselves as 8, 9, or 10 were categorized in the Transformation stage.

Table 6 presents the mean and standard deviations for the teacher technology competency areas. The data are presented in the order they appeared in the assessment for teachers who completed the Professional Competency Continuum V.

Table 6. Mean and Standard Deviation of Teacher Ratings of Technology Integration Competency on the Professional Competency Continuum V.

<table>
<thead>
<tr>
<th>PCC V Teachers Technology Integration Competencies</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core Technology Skills</td>
<td>175</td>
<td>6.41</td>
<td>1.05</td>
</tr>
<tr>
<td>Curriculum, Learning, and Assessment</td>
<td>146</td>
<td>5.69</td>
<td>0.89</td>
</tr>
<tr>
<td>Classroom and Instructional Management</td>
<td>146</td>
<td>6.17</td>
<td>0.88</td>
</tr>
<tr>
<td>Professional Practice</td>
<td>175</td>
<td>6.43</td>
<td>1.08</td>
</tr>
</tbody>
</table>
The mean rating for teachers in PCC V for Core Technology Skills was 6.41; the mean rating for teachers in PCC V for Curriculum, Learning, and Assessment was 5.69; the mean rating for teachers in Phase V for Classroom and Instructional Management was 6.16; and the mean rating for teachers in PCC V for Professional Practice was 6.43. All mean scores for teachers fall in the Adaptive stage.

Table 7 presents the mean and standard deviations for the teacher technology competency areas. The data are presented in the order they appeared in the assessment for teachers who completed the Professional Competency Continuum VI.

Table 7. Mean and Standard Deviation of Teacher Ratings of Technology Integration Competency on the Professional Competency Continuum VI.

<table>
<thead>
<tr>
<th>Technology Integration Competencies</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core Technology Skills</td>
<td>146</td>
<td>5.99</td>
<td>0.90</td>
</tr>
<tr>
<td>Curriculum, Learning, and Assessment</td>
<td>146</td>
<td>5.67</td>
<td>0.90</td>
</tr>
<tr>
<td>Classroom and Instructional Management</td>
<td>146</td>
<td>6.16</td>
<td>0.88</td>
</tr>
<tr>
<td>Professional Practice</td>
<td>146</td>
<td>6.00</td>
<td>0.87</td>
</tr>
</tbody>
</table>

The mean rating for teachers in PCC VI for Core Technology Skills was 5.99; the mean rating for teachers in PCC VI for Curriculum, Learning, and Assessment was 5.67; the mean rating for teachers in Phase VI for Classroom and Instructional Management was 6.16; and the mean rating for teachers in PCC VI for Professional Practice was 6.00. The mean scores for teachers from PCC V to PCC VI all decreased. All mean scores for teachers were in the Adaptive stage (4-7).

Research Questions

Questions 1, 2, 3, and 4 were tested using the Pearson Product Correlation Coefficient. Analyses were carried out for each administrative competency category and...
the technology integration competency skills of teachers under their leadership. The following data were organized and introduced in the order of the research questions listed in Chapter I.

Question 1. What are the relationships between the level of elementary school administrator ratings on the Professional Competency Continuum regarding modeling effective use of technology and the technology integration competencies of teachers under their leadership for the Professional Competency Continuum V and VI?

Tables 8 and 9 present data from the PCC V and VI respectively. The data are grouped by school buildings consequently, administrator ratings are correlated with teacher ratings from the same building. The population represented in this table corresponded to no less than 146 schools.

The data from PCC V (Table 8) indicates there were positive correlations between the ratings of elementary school administrators with regard to modeling effective use of technology and the core technology skills (.416**) and professional practices of teachers (.497**). These two positive correlations were significant at the .001 level. The two remaining correlations, curriculum, learning, and assessment and classroom instructional practices were not significant. This indicates no significant relationship exists between them and the administrators with regard to modeling effective use of technology.
Table 8. Correlations between Administrator Ratings of Modeling Effective Use of Technology and Teacher Ratings of Technology Integration Competencies on the PCC V.

<table>
<thead>
<tr>
<th>Administrative Competency PCC V</th>
<th>Technology Integration Competencies</th>
<th>Core Technology Skills</th>
<th>Curriculum Learning, and Assessment</th>
<th>Classroom and Instructional Management</th>
<th>Professional Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modeling Effective Use</td>
<td>R</td>
<td>.416**</td>
<td>.107</td>
<td>.094</td>
<td>.497**</td>
</tr>
<tr>
<td></td>
<td>Sig.</td>
<td>&lt;.001</td>
<td>.200</td>
<td>.261</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>175</td>
<td>146</td>
<td>146</td>
<td>175</td>
</tr>
</tbody>
</table>

* Significant at the .05 level (2-tailed)
** Significant at the .001 level (2-tailed)

The PCC VI data (Table 9) indicate there were no significant relationships between the administrator competency rating of modeling effective use and the technology integration competencies of teachers who worked for them.

Table 9. Correlations between Administrator Ratings of Modeling Effective Use of Technology and Teacher Ratings of Technology Integration Competencies on the PCC VI.

<table>
<thead>
<tr>
<th>Administrative Competency PCC VI</th>
<th>Technology Integration Competencies</th>
<th>Core Technology Skills</th>
<th>Curriculum Learning, and Assessment</th>
<th>Classroom and Instructional Management</th>
<th>Professional Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modeling Effective Use</td>
<td>R</td>
<td>.059</td>
<td>.098</td>
<td>.089</td>
<td>.129</td>
</tr>
<tr>
<td></td>
<td>Sig.</td>
<td>.478</td>
<td>.238</td>
<td>.286</td>
<td>.120</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>146</td>
<td>146</td>
<td>146</td>
<td>146</td>
</tr>
</tbody>
</table>

* Significant at the .05 level (2-tailed)
** Significant at the .001 level (2-tailed)

Question 2. What are the relationships between the level of elementary school administrator ratings on the Professional Competency Continuum regarding leading professional development and the technology integration competencies of teachers under their leadership for the Professional Competency Continuum V and VI?
Tables 10 and 11 present data from the PCC V and VI. The data are grouped by school buildings consequently, administrator ratings are correlated with teacher ratings from the same building. The population represented in this table corresponded to no less than 146 schools.

The PCC V data (Table 10) indicate there were positive correlations between the ratings of elementary school administrators with regard to leading professional development and the core technology skills (.287**); curriculum, learning, and assessment (.278*); classroom and instructional management (.224*); and professional practices (.401**) of teachers. The core technology skills and professional practices relationships were significant at the .001 level. The teacher competencies of curriculum, learning, and assessment and classroom and instructional management were significant at the .05 level.

Table 10. Correlations between Administrator Ratings of Leading Professional Development and Teacher Ratings of Technology Integration Competencies on the PCC V.

<table>
<thead>
<tr>
<th>Administrator Competency PCC V</th>
<th>Technology Integration Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Core Technology Skills</td>
</tr>
<tr>
<td>Leading Professional Development</td>
<td>r</td>
</tr>
<tr>
<td></td>
<td>Sig.</td>
</tr>
<tr>
<td>N</td>
<td>175</td>
</tr>
</tbody>
</table>

* Significant at the .05 level (2-tailed)
** Significant at the .001 level (2-tailed)

Core technology skills and professional practices present the strongest relationships between administrators and teachers who work for them for PCC V. The data signify a significant relationship between administrators leading professional
development and the technology integration competencies of teachers who work for them.

Table 11 from PCC VI indicates there were positive correlations between the ratings of elementary school administrators with regard to leading professional development and the core technology skills (.170*); curriculum, learning, and assessment (.231*); classroom and instructional management (.193*); and professional practices (.201*) of teachers.

Table 11. Correlations between Administrator Ratings of Leading Professional Development and Teacher Ratings of Technology Integration Competencies on the PCC VI.

<table>
<thead>
<tr>
<th>Administrator Competency PCC VI</th>
<th>Technology Integration Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Core Technology Skills</td>
</tr>
<tr>
<td>Leading Professional Development</td>
<td>r 170*</td>
</tr>
<tr>
<td></td>
<td>Sig. .041</td>
</tr>
<tr>
<td>N</td>
<td>146</td>
</tr>
</tbody>
</table>

* Significant at the .05 level (2-tailed)
** Significant at the .001 level (2-tailed)

All four teacher technology integration competencies were significant at the .05 level. These correlations indicate a significant relationship exists between administrators leading professional development and the technology integration competencies of teachers who work for them.

Question 3. What are the relationships between the level of elementary school administrator ratings on the Professional Competency Continuum regarding leading and managing systemic change and the technology integration competencies of teachers under their leadership for the Professional Competency Continuum V and VI?
Tables 12 and 13 present data from the PCC V and VI respectively. The data are grouped by school buildings consequently, administrator ratings are correlated with teacher ratings from the same building. The population represented in this table corresponded to no less than 146 schools.

The PCC V data (Table 12) indicate there were positive correlations between the ratings of elementary school administrators with regard to leading and managing systemic change and the core technology skills (.247*); curriculum, learning, and assessment (.186*); and professional practices (.347**) of teachers. The core technology skills and curriculum, learning, and assessment were significant at the .05 level. The technology integration competency of professional practice had the strongest relationship with administrators for PCC V and was significant beyond the .001 level.

<table>
<thead>
<tr>
<th>Administrator Competency</th>
<th>Core Technology Skills</th>
<th>Technology Integration Competencies</th>
<th>Currrriculum Learning, and Assessment</th>
<th>Classroom and Instructional Management</th>
<th>Professional Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leading and Managing Systemic Change</td>
<td>r</td>
<td>.247*</td>
<td>.186*</td>
<td>.159</td>
<td>.347**</td>
</tr>
<tr>
<td>Sig.</td>
<td>.001</td>
<td>.024</td>
<td>.056</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>175</td>
<td>146</td>
<td>146</td>
<td>175</td>
<td></td>
</tr>
</tbody>
</table>

* Significant at the .05 level (2-tailed)
** Significant at the .001 level (2-tailed)

There were no significant relationships between administrators leading and managing systemic change and the classroom and instructional management competency of teachers who work for them.
The PCC VI (Table 13) data indicate there were no significant relationships between the rating of elementary school administrators with regard to leading and managing systemic change and the technology integration competencies of teachers who worked for them.

Table 13. Correlations between Administrator Ratings of Leading and Managing Systemic Change and Teacher Ratings of Technology Integration Competencies on the PCC VI.

<table>
<thead>
<tr>
<th>Administrator Competency PCC VI</th>
<th>Core Technology Skills</th>
<th>Technology Integration Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leading and Managing Systemic Change</td>
<td>r</td>
<td>.065</td>
</tr>
<tr>
<td></td>
<td>Sig.</td>
<td>0.437</td>
</tr>
<tr>
<td>N</td>
<td>146</td>
<td>146</td>
</tr>
</tbody>
</table>

* Significant at the .05 level (2-tailed)
** Significant at the .001 level (2-tailed)

Question 4. What are the relationships between the level of elementary school administrator ratings on the Professional Competency Continuum regarding maintaining a knowledge base and the technology integration competencies of teachers under their leadership for the Professional Competency Continuum V and VI?

Tables 14 and 15 present data from the PCC V and VI respectively. The data are grouped by school buildings consequently, administrator ratings are correlated with teacher ratings from the same building. The population represented in this table corresponds to no less than 146 schools.

The PCC V (Table 14) indicates there were positive correlations between the ratings of elementary school administrators with regard to maintaining a knowledge base and the core technology skills (.326**); curriculum, learning, and assessment (.169*);
and professional practices (.424**) of teachers. The core technology skills and professional practices represent the strongest relationships between administrators and the teachers who work for them as they were significant at the .001 level. The curriculum, learning and assessment competencies correlation were significant at the .05 level.

Table 14. Correlations between Administrator Ratings of Maintaining a Knowledge Base and Teacher Ratings of Technology Integration Competencies on the PCC V.

<table>
<thead>
<tr>
<th>Administrator Competency PCC V</th>
<th>Technology Integration Competencies</th>
<th>Core Technology Skills</th>
<th>Curriculum Learning, and Assessment</th>
<th>Classroom and Instructional Practice</th>
<th>Professional Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintaining a Knowledge Base</td>
<td>R</td>
<td>.326**</td>
<td>.169*</td>
<td>.129</td>
<td>.424**</td>
</tr>
<tr>
<td></td>
<td>Sig.</td>
<td>&lt;.001</td>
<td>.041</td>
<td>.121</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>175</td>
<td>146</td>
<td>146</td>
<td>175</td>
</tr>
</tbody>
</table>

* Significant at the .05 level (2-tailed)
** Significant at the .001 level (2-tailed)

No significant relationship existed between the classroom and instructional practices of teachers and the ratings of elementary school administrators with regard to maintaining a knowledge base.

The PCC VI (Table 15) indicates there was a positive correlations between the ratings of elementary school administrators with regard to maintaining a knowledge base and curriculum, learning, and assessment (.177*) which was significant at the .05 level.
Table 15. Correlations between Administrator Ratings of Maintaining a Knowledge Base and Teacher Ratings of Technology Integration Competencies on the PCC VI.

<table>
<thead>
<tr>
<th>Administrator Competency PCC VI</th>
<th>Technology Integration Competencies</th>
<th>Core Technology Skills</th>
<th>Curriculum Learning, and Assessment</th>
<th>Classroom and Instructional Management</th>
<th>Professional Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintaining a Knowledge Base</td>
<td>r</td>
<td>.090</td>
<td>.177*</td>
<td>.137</td>
<td>.135</td>
</tr>
<tr>
<td></td>
<td>Sig.</td>
<td>.278</td>
<td>.033</td>
<td>.099</td>
<td>.105</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>146</td>
<td>146</td>
<td>146</td>
<td>146</td>
</tr>
</tbody>
</table>

* Significant at the .05 level (2-tailed)
** Significant at the .001 level (2-tailed)

The core technology skills, classroom and instructional management, and professional practices of teachers did not show any significant correlations. The summary, conclusions, and recommendations for further study are presented in the next chapter.
CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Chapter V contains the summary, conclusions, recommendations for action, and recommendations for further study.

Summary

The purpose of this study was to examine the relationships between the technology competencies of elementary school administrators and the technology integration competencies of teachers under their leadership. The study used the Professional Competency Continuum to measure administrators’ technology competencies and technology integration competencies of teachers.

Public schools have made significant progress expanding internet access to classrooms. Parsad and Jones (2003) found that by fall 2003, nearly 100% of public schools in the United States had access to the internet. Internet access in public schools has been at or above the 99% range since 1999 (Smerdon et al., 2000). Computers have been in schools for 20 years and most teachers have had some technology professional development. However, there are still a substantial number of school staff members who are talking about integrating technology into the curriculum and classroom but have not effectively or efficiently accomplished this endeavor (Byrom & Bingham 2001).

Byrom and Bingham’s (2001) 5-year intensive technology implementation study in resource-poor schools documented the importance of leadership and the schools vision
for technology integration. In addition, the study acknowledged the fact that technology integration was a slow process and true technology integration needs to be supported by those with expertise in technology pedagogy in order to change teaching practices. Byrom and Bingham also documented evaluation as the weakest element within technology programs.

Sparks and Hirsh (1997) appear to concur with Byrom and Bingham (2001) as all four authors documented the importance of technology staff development that provided a wide variety of learning opportunities for both teachers and administrators.

The advances in technology hardware and software are changing organizations which include educational settings such as public schools (Costello, 1993, 1997; Gurr, 2004; Rivero, 2005). The onset of these technology changes has some questioning our current leadership conceptions and documenting the significant differences between leading and leading technology-mediated environments (Gurr, 2004). These complexities within the change process are what Fullan (2001) referred to as the big problems of the day and concluded that there are no once-and-for-all answers. There is no dispute over the need for students to have knowledge and competence in our increasingly technology-driven global economy and our educational system must be reformed which will require strong leadership (U.S. Department of Education, 2004).

The North Dakota Teaching with Technology initiative (ND TWTi) provided technology training and on-site technical assistance to all North Dakota public and private K-12 teachers and administrators to effectively integrate technology into the existing curriculum (Technology Innovation Challenge Grant Program Performance

59

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Phase I of ND TWTi was completed in May of 2001 and consisted of a classroom educator’s strand and an administrative strand. During this Phase, classroom educators redesigned a lesson that integrated the use of technology to enhance the teaching and learning process. The administrative strand focused on increasing their knowledge base related to technology integration and also worked on modeling the effective use of technology (Technology Innovation Challenge Grant Program Performance Report, 2001).

Phase II of ND TWTi was completed in January of 2003 and consisted of a classroom educator’s strand and a leadership strand. The classroom educator’s strand focused on teaching and learning strategies that would engage students in project-based learning, problem-based learning, and inquiry-based learning. All of these learning strategies would incorporate the use of technology to engage students to work on authentic educational tasks. The leadership participants focused on technology integration processes in their own schools and districts (Technology Innovation Challenge Grant Program Performance Report, 2001).

The primary goal of ND TWTi was to move North Dakota teachers and administrators from Entry to Adaptation and toward transformation on the PCC (Technology Innovation Challenge Grant Program Performance Report, 2001). Transformational or transforming occurs when people engage in a process that changes, broadens and elevates each other to higher levels of motivation and performance (Burns, 1978; Epitropaki, 2001; & Marzano et al., 2005). The PCC identifies five key target
areas for improving educational technology which included core technology skills, curriculum, learning and assessment, professional practices, classroom and instructional management, and administrative competencies.

The administrator technology competencies included modeling effective use, leading professional development, leading and managing systemic change, and maintaining a knowledge base. The data from Phases I and II of ND TWTi included K-12 administrators. The mean values for the administrator competencies during Phases I and II of ND TWTi all fell in the adaptation range (4-7) and all increased from Phase I to Phase II. The mean values ranged from a low of 4.27 for leading professional development in Phase I to a high of 7.43 for leading and managing systemic change in Phase II.

The data collected in PCC V and VI consisted of elementary administrators. The mean values in PCC V and VI all fell in the upper adaptation range (4-7). The mean values ranged from a low of 6.96 for leading and managing systemic change on PCC V to a high of 7.74 for modeling effective use on PCC V. The administrator competency of modeling effective use decreased from a mean value of 7.74 in PCC V to 7.72 in PCC VI. The remaining administrator competencies increased from PCC V to PCC VI. The mean values for the administrator competency areas never reached the transformational range of 8 to 10 during Phase I of ND TWTi to the PCC IV. The continued increase in administrator mean values for leading and managing systemic change, leading professional development, and maintaining a knowledge base are all signs that administrators are confident in these technology competency areas.
The technology integration competencies for teachers included core technology skills, curriculum, learning, and assessment, classroom instructional management, and professional practices. The data from Phases I and II of ND TWTi included K-12 teachers. The mean values for the teacher competency areas of curriculum, learning and assessment and professional practices during Phase I fell in the entry level range (1-3) while core technology skills and classroom instructional management fell in the low adaptive range (4-7). During Phase II of ND TWTi, all teacher competencies increased and fell in the adaptive range (4-7). The mean values ranged from a low of 3.83 for curriculum, leaning, and assessment in Phase I to a high of 5.38 for classroom and instructional management in Phase II.

The data collected in PCC V and VI consisted of elementary teachers. The mean values in PCC V and VI all fell in the adaptation range (4-7). The mean values ranged from a low of 5.67 for curriculum, instruction, and assessment on PCC VI to a high of 6.43 for professional practice on PCC V. Although all mean values increased from Phase II to the PCC V, the teacher technology integration competencies from PCC V to PCC VI all decreased. The data from PCC V and VI indicates that although mean values of administrators are increasing the mean values of teachers who work for them are not.

Feldner (2003) documented correlations between North Dakota administrator ratings on the Professional Competency Continuum and the technology integration competencies of teachers who worked for them during Phases I and II of ND TWTi. This included no less than 295 different K-12 schools across the state of North Dakota that participated in both phases of ND TWTi. Feldner (2003) concluded that the ratings of administrators with regard to technology integration competencies are related to teachers’
ratings on technology integration competencies. In fact, with exception to administrators’ leading and managing systemic change and teachers’ curriculum, learning, and assessment and classroom and instructional practices competency in Phase II all correlations were significant at the .001 level. The successes of the ND TWTi and its associated professional development for teachers and administrators across the state of North Dakota are documented in PCC I, II, III, and IV. However, the PCC V and VI do not corroborate the same findings.

Conclusions

Data for each research question were tested using the Pearson Product Correlation Coefficient. Analyses were carried out to determine if there were significant relationships between the level of elementary school administrator ratings on the Professional Competency Continuum and the technology integration competencies of teachers under their leadership for the Professional Competency Continuum V and VI.

Question 1 Conclusions

Question 1. What are the relationships between the level of elementary school administrator ratings on the Professional Competency Continuum regarding modeling effective use of technology and the technology integration competencies of teachers under their leadership for the Professional Competency Continuum V and VI?

The data for this research question yielded two positive correlations out of a possible eight. A positive correlation between administrators’ modeling effective use and teachers’ (a) core technology skills (.326**) and (b) professional practices (.424**) in PCC V were significant at the .001 level but were the only significant relationships that existed in PCC V and VI.
The mean values for administrators modeling effective use are in the adaptation range on the PCC V and VI. The modeling effective use administrator competency had the highest mean values among the administrator competencies. The administrator mean value from PCC V was 7.74 while the PCC VI mean value was 7.72. These mean values both fall in the upper Adaptation stage. The Adaptation stage is where administrators have primarily applied technology skills to automate, accelerate, and enhance the technology processes already in place. The mean values for modeling effective use for both years bordered on the Transformation stage. At this level, North Dakota elementary principals are supposed to be excellent role models for the effective use of technology, this is not the case. Administrators are scoring themselves too high on the PCC or are not modeling for their teachers appropriate uses of technology.

Feldner (2003) studied K-12 administrators and teachers. This study only looked at elementary administrators and teachers. Feldner determined that modeling effective use of technology by administrators may be a determinant in the technology integration competency ratings of teachers under their leadership, the data from PCC V and VI do not bear out the same results. The administrator mean values on PCC V and VI are higher than the mean values during Phases I and II. These data indicated it is possible to move administrators from Entry stage toward the Transformation stage on the PCC and not establish significant relationships between the competencies of administrators and the technology competencies of teachers who work for them.

The reason for the above average mean values for modeling effective use could be explained by administrators scoring themselves higher on the PCC V and VI due to the fact that the PCC instrument has been used for 6 consecutive years. The increase in mean
value does not appear to correspond with the notion that technology is changing at a rapid pace. If technology was changing at a rapid pace, one would think the mean values of modeling effective use of technology would drop due to the fact that administrators are learning how to use the new technologies and, therefore, be at the Entry stage (1-3).

The lack of other statistically significant relationships from PCC V to PCC VI could be related to the lack of state-wide professional development due to funding and the coordinated leadership which was offered in Phase I. The administrative strand in Phase I focused on administrators working on modeling the effective use of technology. The state-wide leadership and coordinated professional development does not appear to be as visually advertised or appealing as it was during the onset of ND TWTi. ND TWTi infused millions of dollars into the state to support technology competencies of teachers and administrators. These funds were used to pay teachers and administrators to take part in this professional development which was conducted by knowledgeable staff and lead by effective leaders. Now that the funding is gone, school districts are on their own to support the advancement of technology with locally generated funds and those that are currently a part of Title II Part D. This funding does not equate to the level of support North Dakota received during ND TWTi.

**Question 2 Conclusions**

Question 2. What are the relationships between the level of elementary school administrator ratings on the Professional Competency Continuum regarding leading professional development and the technology integration competencies of teachers under their leadership for the Professional Competency Continuum V and VI?
The relationships between the level of elementary school administrator ratings on the Professional Competency Continuum regarding leading professional development and the technology integration competencies of teachers under their leadership for the Professional Competency Continuum V and VI indicated positive correlations for both PCC V and VI. The data for this research question yielded eight positive correlations out of a possible eight. All correlations were significant at the .05 level while teachers’ (a) core technology skills (.287**) and (b) professional practices (.401**) in PCC V were significant at the .001 level.

The leading professional development administrator competency had the second highest mean values among the administrator competencies. The administrator mean value from PCC V was 7.40 while the PCC VI mean value was 7.49. These mean values both fall in the upper Adaptation stage (4-7) and fall short of the Transformation stage (8-10). When North Dakota administrators reach the Transformation stage in leading professional development, and we are close, we consider it to be critically important to furthering the technology competencies of teachers. According to the data from PCC V and VI, North Dakota administrators consider technology staff development a priority. The data indicates the relationships are stronger in PCC V than PCC VI which may indicate that leading technology professional development is not a priority and is waning.

The leading professional development administrator competency is the only competency area to have existing significant relationships between an administrator competency and all teacher integration competencies for both PCC V and PCC VI. This sustained relationship for 2 years could be attributed to the professional development provided to administrators during ND TWTi which focused on participants integrating

66
technology processes in their own schools and districts. Although the data indicated significant relationships existed in all four teacher competency areas for both years, it is noteworthy that the relationships were stronger on PCC V than on PCC VI. This decrease in relationship includes (a) core technology skills dropping from .287** on PCC V to .170* on PCC VI; (b) curriculum, learning, an assessment dropping from .278** on PCC V to .231* on PCC VI; (c) classroom instructional practices dropping from .224* on PCC V to .193* on PCC VI; and (d) professional practices .401** on PCC V to .201* on PCC VI. One reason for the decline in the relationship between leading professional development is the substantial pressure placed on school to make adequate yearly progress (AYP) on the North Dakota State Assessment (NDSA). The NDSA measures student progress in mathematics and reading and does not measure the technology integration competencies of teachers or the technology competencies of administrators. Considering schools are measured on mathematics and reading, professional development in schools is centered on these curricular areas. The North Dakota Reading First initiative is an excellent example of a comprehensive elementary school reading initiative that consumes a vast amount of professional development time within elementary schools. In addition, the elementary school staff development time during the PCC V and VI was usually limited to before and after school. Only recently have districts infused staff development into the regular school calendar year.

*Question 3 Conclusions*

Question 3. What are the relationships between the level of elementary school administrator ratings on the Professional Competency Continuum regarding leading and
managing systemic change and the technology integration competencies of teachers under their leadership for the Professional Competency Continuum V and VI?

The data for this research question yielded three significant relationships out of a possible eight. A positive correlation between administrators' leading and managing systemic change and teachers' (a) core technology skills (.247*) and (b) curriculum, learning, and assessment (.186*) were significant at the .05 level while teachers' (c) professional practices (.347**) were significant at the .001 level. All three of these correlations existed in PCC V and were the only significant relationships that existed in PCC V and VI.

The data suggests that leading and managing systemic change by administrators are in the adaptation stage on the PCC V and VI. The leading and managing systemic change administrator competency had the lowest mean values among the administrator competencies. The administrator mean value from PCC V was 6.96 while the PCC VI mean value was 7.01. These mean values both fall in the adaptive stage. At this stage, North Dakota administrators are supposed to understand the systemic change and actually engage their staff in the change process regularly. Administrators are rating themselves in the Adaptation stage in PCC V and upper adaptation level in PCC VI but the data from PCC VI does not support their increasing mean values. The significant relationships between administrators leading and managing systemic change and the teacher integration competencies on PCC VI are none existent.

The administrator mean values on PCC V and VI are actually lower than the mean values during Phase II. This may be attributed to the fact that during Phases I and II administrators were actually working on leading initiatives in their buildings and were
supported by leaders from ND TWTi. The administrators' leading and managing systemic change is the one administrative competency area were mean value data dropped from a high in Phase II of 7.43 to 7.01 on PCC VI.

Feldner (2003) studied K-12 administrators and teachers and determined that leading and managing systemic change by administrators during Phase I may be a determinant in the technology integration competency ratings of teachers under their leadership. The data from PCC V and VI does not bear out the same results. In fact, there was not a significant relationship between administrators' leading and managing systemic change and teachers' (a) classroom instructional practice during PCC V.

Phase II data from Feldner (2003) indicated no significant relationships between administrators' leading and managing systemic change and teachers' (a) curriculum, learning, and assessment; and (b) classroom and instructional management. The PCC VI data confirms Feldner's (2003) findings. In addition, the PCC VI data indicated no significant relationships existed between administrators' leading and managing systemic change competency and any of the teacher integration competencies.

The leadership strand in Phase II had administrators focused on the integration of technology processes in their own schools and districts. The lack of statistically significant relationships from PCC V to PCC VI is due in part to the fact the systemic changes in elementary schools are not related to the integration of technology but instead they are focused on reading and mathematics. As stated before, the AYP that is expected of schools has outweighed the importance of moving technology forward.

In addition, leading and managing any systemic change takes time and professional development opportunities. Only recently have districts infused staff
development into the regular school calendar year. The researcher contends that it is important enough to restate that the lack of statistically significant relationships from PCC V to PCC VI may be related to the lack of state-wide professional development and the coordinated leadership which was offered throughout ND TWTi.

**Question 4 Conclusions**

Question 4. What are the relationships between the level of elementary school administrator ratings on the Professional Competency Continuum regarding maintaining a knowledge base and the technology integration competencies of teachers under their leadership for the Professional Competency Continuum V and VI?

The relationships between the administrative competency area of maintaining a knowledge base and the technology integration competencies of teachers under their leadership for the Professional Competency Continuum V and VI indicated three significant relationships for PCC V and one significant relationship for PCC VI. The data for this research question yielded four significant relationships out of a possible eight. The teachers’ curriculum learning, and assessment competencies for PCC V and VI were significant at the .05 level while teachers’ (a) core technology skills (.326**) and (b) professional practices (.424**) in PCC V were significant at the .001 level.

The administrator competency of maintaining a knowledge base had the third highest mean values among the administrator competencies. The administrator mean value from PCC V was 7.04 while the PCC VI mean value was 7.05. These mean values both fall in the upper Adaptation stage (4-7) but fall short of the Transformation stage. North Dakota administrators are characterized as having a working knowledge of effective technology practices but their knowledge may be limited and do not have the
strategies to stay abreast of new technology developments. The mean values of PCC V and VI are higher than those in Phases I or II. The administrative competency of maintaining a knowledge base should have a mean value that is decreasing due to technology advancement in recent years. The opposite is happening as technology advancement increases so do the mean values of the administrator competency of maintaining their knowledge. Administrators' ratings on the PCC are overstated and do not match their current practices.

Feldner (2003) studied K-12 administrators and teachers and determined that maintaining a knowledge base of technology by administrators may be a determinant in the technology integration competency ratings of teachers under their leadership. In fact, Feldner's (2003) data indicated maintaining a knowledge base was the strongest correlations of the administrator competency areas. The data from PCC V and VI does not bear out the same results. With the exception of administrators maintaining a knowledge base and teachers' (a) curriculum, learning, and assessment on PCC V and VI the lack of statistically significant relationships from PCC V to PCC VI may be linked to the absence of ND TWTi.

The onset of ND TWTi sparked the technology interest across the state of North Dakota. This 5-year professional development initiative was supported by comprehensive technology professional development, technology leadership at the state and region level, and exposure of new technologies to teachers and administrators across the state of North Dakota. Local districts were to build the internal capacity to ensure technology was supported within schools. There appears to be new factors that are influencing administrators and teachers in North Dakota including high stakes testing
centered on mathematics and reading, a lack of technology funding, and the scarcity of time for professional development. New technologies are rapidly changing the landscape of education and elementary school administrators are struggling to maintain a knowledge base. As stated by Byrom and Bingham (2001), there is substantial number of school staff members who are talking the talk but not walking the walk when it comes to technology integration within schools.

These results lead the researcher to believe that the data from the self-reporting PCC is misleading. Administrators and teachers are scoring themselves higher than their actual skills. It may be interesting to determine the relationships that exist between the self-reporting PCC assessment and the actual technology practices of administrators. This may be an issue for further study.

The impact of ND TWTi, that Feldner (2003) determined as significant and positive in the technology integration competencies of teachers and administrators may have future effects. The lack of a state-wide coordinated technology effort that has the appeal of ND TWTi is impacting the technology integration competencies of teachers and administrators. It may be interesting to determine the relationship between this study’s data and the information collected from administrators’ competencies and teachers’ integration competencies for PCC VII.

Recommendations for Action

Today’s students need to have technology skills to compete for jobs in our technology-driven global economy. Educators need to know how to use and integrate technology into their work in order to implement innovative strategies that will reshape education. The education community needs to graduate students from schools and
universities that have necessary technology competencies that will carry us into the 22\textsuperscript{nd} Century.

In order to accomplish this task the following actions should be considered:

1. The North Dakota State Legislature needs to fund technology at levels that allow schools and universities opportunities to advance technology integration. The funding should be allocated specifically for the use, support, and leadership of technology. Comprehensive technology reforms such as ND TWTi should be supported in its original format including funding for ND TWTi leadership to facilitate the integration of technology throughout the state of North Dakota. Without additional technology funding, strong technology leadership at the state, regional, district, and school levels North Dakota will continue to see the integration of technology across disciplines decline. This steady decline in technology integration will ultimately impact the ability of our students to garner jobs in a globally competitive job market.

2. The North Dakota Department of Public Instruction needs to work collaboratively with schools to ensure that the content areas mathematics, reading, and science are not the only priorities for school improvement. New state technology integration plans need to be developed and implemented that reward school districts for cutting-edge technology practices that are proven and effective. It is imperative that students graduate high school and universities with the ability to use technology to enhance their learning and ensure North Dakota is a nationally and internationally competitive in the job market.
3. School districts and universities need to view the integration of technology in all curriculum areas as a priority. This includes increasing locally-generated funding and reprioritizing existing funds for technology staff development, technology hardware and software, and establishing appropriate technology supports. This needs to be a sustained effort over a long period of time. If technology is going to be sustained, it will take time, funding, and leadership. School districts need to be cautious about spending all their staff development funds in areas that only impact Annual Yearly Progress such as mathematics and reading. The long-term effects of ignoring technology will ultimately lead to North Dakota being disconnected from the global economy.

Recommendations for Further Study

The ND TWTi and the PCC contains a vast amount 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 elementary schools.

1. Further study should be conducted to determine if the administrator ratings on the Professional Competency Continuum match their actual technology practices. This study should include a qualitative review of administrators' actual practices compared to their self-reported Professional Competency Continuum ratings. If actual technology practices do not match the self-reported data on the PCC, accurate comparisons can not be made using the PCC data. The actual practices may shed light on how to advance the integration of technology.
2. Further study should be conducted to determine if the teacher ratings on the Professional Competency Continuum match their actual technology practices. This study should include a qualitative review of administrators' actual practices compared to their self-reported Professional Competency Continuum ratings. If actual technology practices do not match the self-reported data on the PCC, accurate comparisons cannot be made using the PCC data. The actual practices may shed light on how to advance the integration of technology.

3. Further study should be conducted in 2008 and 2009 to determine if the administrators' technology competencies and the technology integration competencies of teachers on the PCC VII and PCC VIII continue to decline. A further decline may indicate the lack of an effective state-wide technology plan, a lack of technology leadership, a lack of technology funding at the national, state, and local levels or the PCC is not a valid instrument for measuring technology integration, when used as a stand alone document.

4. Further study should be conducted to determine how technology funding from ND TWTi and Title II Part D has impacted the technology integration competencies of administrators and teachers. This study should include comprehensive qualitative reviews of state and district funding patterns to determine how past and current funding is allocated to improve the competencies of administrators and teachers. This may add to the literature the fiscal component so that funding could be ruled in or out as a possible variable for the integration of technology.
APPENDICES
Appendix A
Letter Requesting Use of Data

November 14, 2006

Dear Dr. Tanna Kincaid:

I am a doctoral student with the University of North Dakota. I am requesting the use of data collected from the TWTi Professional Competency Continuum Assessment for teachers and administrators.

The purpose of this study is to examine the relationships between elementary school administrators with transformational technology skills and the technology integration skills of teachers under their leadership. This data will be used for research purposes only and will assist me in answering the following questions:

- Question 1. What is the relationship between elementary school administrators with transformational ratings on the Professional Competency Continuum regarding modeling effective use of technology and the technology integration competencies of teachers under their leadership?
- Question 2. What is the relationship between elementary school administrators with transformational ratings on the Professional Competency Continuum regarding leading professional development and the technology integration competencies of teachers under their leadership?
- Question 3. What is the relationship between elementary school administrators with transformational ratings on the Professional Competency Continuum regarding leading and managing systemic change and the technology integration competencies of teachers under their leadership?
- Question 4. What is the relationship between elementary school administrators with transformational ratings on the Professional Competency Continuum regarding maintaining a knowledge base and the technology integration competencies of teachers under their leadership?

Thank you for your time and consideration

Jason D. Hornbacher
Doctoral Student, UND
November 27, 2006

Dear Mr. Hornbacher,

I am happy to allow you the use of the PCC data to gain a better understanding of the leadership and technology competency. The conditions under which you are granted permission are:

(1) No data is to be reported that divulges the identities of individuals.

(2) Data is only to be reported in aggregate form and only for subgroups greater than five (5).

Best wishes in your research.

Sincerely,

Tanna Kincaid
REFERENCES


80


