TEACHING TEACHERS TECHNOLOGY
THROUGH THE PROFESSIONAL LEARNING COMMUNITY

by

Callie Watts Dollar

Dissertation

Submitted to the Faculty of
Trevecca Nazarene University
School of Education
in Partial Fulfillment of the Requirements for
the Degree of

Doctor of Education

in
Leadership and Professional Practice

May 2009
TEACHING TEACHERS TECHNOLOGY
THROUGH THE PROFESSIONAL LEARNING COMMUNITY

by

Callie Watts Dollar

Dissertation

Dissertation Adviser __________________ Date __________________

Dissertation Reader __________________ Date __________________

Dissertation Coordinator __________________ Date __________________

Dean of the School of Education __________________ Date __________________

University Provost __________________ Date __________________
ACKNOWLEDGEMENTS

I wish to thank those who pushed me along this path; without your help I would have never recovered from all the stumbles. Dr. Alice Patterson and Dr. Brad Windley, thank you for your sage advice and much needed criticism. I would also like to thank the faculty and staff who graciously participated in this research study. Finally, I would like to thank my editor, my husband, Patrick. I have known no other person with such expertise and passion for the written word. This accomplishment is yours to share.
DEDICATION

I dedicate this work to my mother, Sandra June Smith Watts, for giving up dreams to make mine possible. I thank you; I love you.
ABSTRACT

by
Callie Watts Dollar, Ed.D.
Trevecca Nazarene University
May 2009

Major Area: Leadership and Professional Practice Number of Words: 107

This study addressed the implementation of a Professional Learning Community into an intact middle school faculty, located in Middle Tennessee, in order to teach technology skills. The researcher gave both a pre- and post-test to measure technology skills of both a treatment and a non-treatment group. The treatment group was then placed into the supportive culture of a Professional Learning Community where participants were then exposed to five training sessions on various technological skills. At the conclusion of the study, it was found that teachers who participated in the treatment group showed gains in the technology skills which were specifically addressed by the research study.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Statement of the Problem</td>
<td>3</td>
</tr>
<tr>
<td>Background</td>
<td>5</td>
</tr>
<tr>
<td>Research Questions</td>
<td>7</td>
</tr>
<tr>
<td>Description of Terms</td>
<td>8</td>
</tr>
<tr>
<td>Significance of the Study</td>
<td>9</td>
</tr>
<tr>
<td>Process to Accomplish</td>
<td>11</td>
</tr>
<tr>
<td>II. REVIEW OF THE LITERATURE</td>
<td>14</td>
</tr>
<tr>
<td>Introduction</td>
<td>14</td>
</tr>
<tr>
<td>Technology: Students and Teachers</td>
<td>16</td>
</tr>
<tr>
<td>Professional Learning Communities</td>
<td>35</td>
</tr>
<tr>
<td>Conclusions</td>
<td>40</td>
</tr>
<tr>
<td>III. METHODOLOGY</td>
<td>41</td>
</tr>
<tr>
<td>Introduction</td>
<td>41</td>
</tr>
<tr>
<td>Research Design</td>
<td>43</td>
</tr>
<tr>
<td>Population</td>
<td>46</td>
</tr>
<tr>
<td>Data Collection</td>
<td>47</td>
</tr>
<tr>
<td>Analytical Methods</td>
<td>51</td>
</tr>
<tr>
<td>Chapter</td>
<td>Page</td>
</tr>
<tr>
<td>-------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Limitations</td>
<td>52</td>
</tr>
<tr>
<td>IV. FINDINGS AND CONCLUSIONS</td>
<td>55</td>
</tr>
<tr>
<td>Introduction</td>
<td>55</td>
</tr>
<tr>
<td>Findings</td>
<td>56</td>
</tr>
<tr>
<td>Summary of the Findings</td>
<td>64</td>
</tr>
<tr>
<td>Conclusions</td>
<td>68</td>
</tr>
<tr>
<td>Recommendations</td>
<td>71</td>
</tr>
<tr>
<td>Implications</td>
<td>72</td>
</tr>
<tr>
<td>Deliverables</td>
<td>74</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>76</td>
</tr>
<tr>
<td>APPENDIXES</td>
<td></td>
</tr>
<tr>
<td>A. Technology Skills Pre- &amp; Post-Test</td>
<td>84</td>
</tr>
<tr>
<td>B. Consent to Participate</td>
<td>91</td>
</tr>
<tr>
<td>C. TNU Institutional Review Board Letter of Approval</td>
<td>93</td>
</tr>
<tr>
<td>D. Approval Letter from Local School Administration</td>
<td>95</td>
</tr>
<tr>
<td>E. Table 1</td>
<td>97</td>
</tr>
<tr>
<td>F. Table 2</td>
<td>99</td>
</tr>
<tr>
<td>G. Table 3</td>
<td>101</td>
</tr>
<tr>
<td>H. End of Technology Training Reflection/Review</td>
<td>103</td>
</tr>
<tr>
<td>I. Presentation Feedback Survey</td>
<td>105</td>
</tr>
<tr>
<td>J. Digital Survey</td>
<td>107</td>
</tr>
</tbody>
</table>
# LIST OF TABLES AND FIGURES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Descriptive Statistics for Technology Skills Pre-Test and Post-Test</td>
<td>98</td>
</tr>
<tr>
<td>2. F-Values for Mixed-Model ANOVAs</td>
<td>100</td>
</tr>
<tr>
<td>3. Feedback Survey Responses</td>
<td>102</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Figure</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Six Design Principles</td>
<td>26</td>
</tr>
<tr>
<td>2. P21 Framework for 21\textsuperscript{st} Century Skills</td>
<td>34</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION

Today’s educator is responsible for teaching to what is commonly referred to as the *Internet generation*. The body of learners that passes through the halls of education from this point forward will have no recollection of a previous time when the World Wide Web (WWW) did not exist. With the advent of devices such as the MP3 player and digital camera comes an age of students who are increasingly digital. It should be no surprise that these students also most enjoy learning through the use of varied digital media.

However, the issue faced by many teachers is not necessarily a lack of willingness to teach to this *Internet generation* through forms of digital media but rather a lack of up-to-date technological training and preparedness. The solution to this problem is economically practical, and most schools currently have the resources within their reach to resolve this quandary. Through a system that utilizes a Professional Learning Community (PLC), teachers could glean this knowledge of technology from their colleagues in an environment that is conducive to accomplishing a shared goal (Johnson and Johnson, 1999).

In 2000, the National Council of Accreditation of Teacher Education (NCATE) introduced six new standards for colleges of education. Five of these new standards required colleges of education to have their perspective graduates
integrate various forms of technology into their conceptual framework and throughout coursework (Wise, 2000). Additionally, the International Society for Technology in Education (ISTE) National Educational Technology Standards (NETS) for Teachers states six performance indicators that should serve as guidelines for teachers who are currently in the classroom:

1. Teachers should demonstrate a sound understanding of technology operations and concepts.
2. Teachers should plan and design effective learning environments and experiences supported by technology.
3. Teachers should implement curriculum plans that include methods and strategies for applying technology to maximize student learning.
4. Teachers should apply technology to facilitate a variety of effective assessment and evaluation strategies.
5. Teachers should use technology to enhance their productivity and professional practice.
6. Teachers should understand the social, ethical, legal, and human issues surrounding the use of technology in PK-12 schools and apply those principles in practice. (ISTE, 2007 ¶ 6)

Furthermore, the Tennessee State Standards for Teachers (2006) states in Standard 11 that educators should “supplement, enhance, facilitate, seek out, use, gather, sort, compile, design, manage, select, perform, trouble-shoot, analyze, integrate, share, change, and explore” (¶ 4) various forms of technology
in order to provide hands-on experiences and activities that are engaging for students, as well as to enhance their own professional growth and productivity (Tennessee State Standards for Teachers).

In order to accomplish these national and state goals, teachers must be able to integrate a myriad of technological operatives and functions into their existing body of knowledge and adapt them to their teaching styles. To ascertain these goals, teachers could depend on a PLC formed by fellow teachers in order to create a learning situation that encourages both teamwork and a common objective. Johnson and Johnson (2000) stated that these learning goals can be mastered in the subject area of focus only through cooperative learning where the intention is to strive for group success. Further, when individuals strive for group success, they tend to view the rewards and accomplishments of the group as unlimited and see that “what benefits self, benefits others” (p. 6).

Statement of the Problem

The purpose of this study was to determine teachers’ barriers to technology, the technology skill and use level of teachers in the studied environment, and to what extent teachers participating in a PLC would gain knowledge of technology by training cooperatively. One of the major problems in the milieu of secondary education today is a great disparity between student use and knowledge of technology versus teacher use and knowledge of technology.
Tapscott (1998) referred to some 88 million students across the United States and Canada as the *Net Generation*. Again, the present generation of learners lives in a culture whose methods of interactive learning have been shaped by an emerging “digital media culture.” (¶ 16) These learners represent a *paradigm shift* in learning from what Tapscott referred to as *broadcast learning* to what he termed as *interactive learning*. Tapscott described previous *broadcast learning* as learning that is instructional, textbook-based, teacher-centered, and hierarchical. He described the emergence of *interactive learning* that has been brought about by the WWW as constructivist, learner-centered, self-manipulative, and as a style of learning that utilizes the teacher as the facilitator instead of the transmitter of knowledge. Tapscott emphasized that as teachers and students move toward and exploit digital media they will encounter a “shift to a new, more powerful and effective learning paradigm.” (¶ 27)

Though teachers recognize the need to integrate technology into the classroom, it has been shown that approximately “one-third of schools do not have the facilities to effectively teach teachers to integrate computers” (Matsuo, 2005, ¶ 1) or other forms of technology into their students’ learning. In 2001, Ross questioned a group of teachers about their feelings towards learning technology skills. These teachers expressed feelings of embarrassment, a lack of confidence, apprehension, a sense of being overwhelmed, fear, and feeling deficient of the knowledge to learn new technology (Ross, Ertmer, & Johnson, 2001). Furthermore, a number of teachers tend to rely more heavily on
prepackaged instructional materials viewing technology as a crutch rather than a tool for teaching (Matsuo). Additionally, various barriers prevent many teachers from implementing forms of technology into the classroom. These barriers include, but are not limited to, a “lack of effective staff development” (Eiser & Salpeter, 1992, p. 53), staff training that provides “no follow-up or reinforcement” (Eiser & Salpeter) and a lack of time and support by administration to strengthen their technological skills (Starr, 2000).

Background

In 1994, Kulik stated, “Students learn more in less time when they receive computer-based instruction” (p. 4). In addition, students who use technology have shown markedly improved attitudes toward learning as well as self-concept (Sivin-Kachala, 1998). Additionally, students who had consistent access to various forms of technology increased their standardized testing scores, which led their teachers to become more enthusiastic about using technology in the classroom (Mann, Shakeshaft, Becker & Kottkamp, 1999). Finally, it has been shown that students show positive gains in all subject areas when they experience learning environments rich in technology (Sivin-Kachala).

Vanatta & Fordham’s (2004) research has shown that it is often the sense of personal beliefs that serves as a predictor for technology use in the classroom. These beliefs are vocalized in Zhao & Cziko’s (2001) Perceptual Control Theory (PCT). Zhao & Cziko’s PCT points to three indices that must exist in order for educators to adopt technology into the classroom:
1. The teacher must believe that technology can more effectively meet a higher-level goal than what has been used.

2. The teacher must believe that using technology will not cause disturbances to other higher-level goals that he or she thinks are more important than the one being maintained.

3. The teacher must believe that he or she has or will have sufficient ability and resources to use technology. (p. 114)

According to McKenzie (2001), linking technology-based instruction to an informal support system or partnership within the school is necessary to make learning meaningful for teachers. McKenzie further stated that efficacious technology learning for educators takes place when peer coaching from colleagues with technological knowledge is readily available as frustrations from technology arise. Additionally, Vanatta & Fordham (2004) suggested that schools provide regular opportunities for educators to collaborate and demonstrate various technology-enhanced lessons.

Matsuo (2005) stated that in order to close the training gap between veteran teachers and beginning teachers in the field of technology, programs to teach technology to teachers “should be taught by other teachers” (¶15). Bandura (1993) further agreed with this scenario and stated that teachers should take part in vicarious learning or through the observation and practice of other professionals.
Thus, in order for effective technology-learning to take place, teachers must be in an environment of support and learning created and experienced by other teachers. This environment must be one that is conducive toward feelings of success. Teachers could find the support and encouragement they need to learn technology by creating a PLC led by and composed of fellow teachers. This style of learning has been shown to increase interest among the participants and promote critical thinking while holding members of the groups accountable for their own learning and still making significant group contributions (Gokhale, 1995). McKenzie (2001) suggested that teachers learn best when they work cooperatively together in teams with collaborative structures. Additionally, McKenzie stated that the most “remarkable technology learning” (p. 86) takes place among teachers when they gain technological knowledge that is practical and applicable to classroom use.

Research Questions

The exhaustive review of literature suggests that teachers who lack knowledge and skills in the arena of technology use and integration in the classroom are most likely to benefit from a PLC. These groups should be composed of fellow teachers who share the same experiences and hold one another accountable for learning while additionally supporting and encouraging one another throughout the process. In addition, research by Bandura (1993) suggests that once these teachers begin to experience feelings of self-efficacy, they will become more willing and apt to experiment independently with various
forms of technology. Earlier research by Hord (2004) and DuFour and Eaker (1998), suggests that teachers of secondary students would benefit most from training sessions that are designed as a PLC. Thus, three questions drove this research:

1. What is the technological skill and use level of the teacher population in the studied environment?
2. What are the barriers inhibiting technological use in the middle school classroom?
3. To what extent will a PLC environment encourage the use of technology?

Description of Terms

*Broadcast Learning.* A method of teaching that is especially teacher-centered. Described as one-size-fits-all instruction that is linear or serial, with the teacher as the only transmitter of materials (Tapscott, 1998).

*Collaboration.* People coming together in groups which respect and highlight individual group members’ abilities and contributions (Panitz, 1996).

*Cooperation.* A set of processes which help people interact together in order to accomplish a specific goal or develop an end product (Panitz, 1996).

*Digital Data.* Information stored electro-magnetically in the form of a digital code.

*Digital Immigrant.* Those who were not “born into the digital world” (Prensky, 2001, p. 1) but have adopted various forms of technology later in life..

*Digital Media.* A storage device that holds digital data.
**Digital Media Culture.** Those who actively and daily use various forms of digital technologies to learn, shop, work, play, and communicate.

**Digital Native.** The *native speakers* of digital language. These *native speakers* were born into a society that is increasingly digital (Prensky, 2001).

**Interactive Learning.** A method of teaching that is especially student-centered. Described by Tapscott in 1998 as customized learning that uses the teacher as a facilitator of learning how to learn in order to create lifelong learners.

**Professional Learning Community.** A collegial group of administrators and school staff who are united in their commitment to student learning. They share a vision, work and learn collaboratively, visit and review other classrooms, and participate in decision-making (Hord, 1997).

**Self-Regulation.** Individualistic control of one’s own emotional, behavioral, motivational, and learning behaviors (Bandura, 1994).

Significance of the Study

Personal experience of the researcher is the primary motivation behind this research. Upon entering the field of middle school education, the researcher was surprised at the amount of technology that was provided by the county school system in comparison to the lack of utilization of this technology by the teaching faculty of the particular middle school in which the researcher worked. Though various forms of technology were readily available for teacher use and implementation into the classroom, only a small number of teachers were
utilizing the resources. Additionally, there was a lack of an ongoing or cohesive general technological training program for the entire faculty.

Sprague (2004) explained that lack of technology knowledge and use in the classroom may be because for many teachers, technology was not a major part of their educational preparation program. Further, November’s (2001) best-selling work states that many teachers are digital immigrants who have little to no experience in using the most recent forms of technology.

Schacter’s research for the Milken Exchange (1999) adds, “students learn more in less time” (p. 4) when technology is integrated. Mann’s (1999) research showed an improved positive attitude toward technology by both students and teachers when there was consistent access to technology. Further, Mann found the greatest achievement growth in standardized testing when teachers were properly trained in the use of technology. However, previous research by McKenzie (2001) found that approximately 60% of teachers surveyed received less than five hours of technology training annually. Thus, a research study that develops a new approach to teaching teachers technology and how to integrate it in the classroom would greatly benefit education. Finally, this research could lead to the implementation of a PLC program that is not only effective but also cost-efficient with little to no need for financial investment in order to be implemented.
Process to Accomplish

The researcher tested the entire faculty of a large, suburban middle school in Middle Tennessee and identified the participants using data collected from the Technology Skills Pre-Assessment Test created by Johnson (1995 & 2007), Director of Media and Technology for the Mankato Public Schools in Minnesota. (See Appendix A). Using these identifiers, the researcher divided the population into treatment and non-treatment groups. The non-treatment group did not participate in the PLC, and the treatment groups received the technological training via a PLC.

After identification, participants were grouped into heterogeneous PLC teams based on scores from the Technology Skills Pre-Assessment Test (TSPRT). Of the five total groups, four groups consisted of four members, and one group consisted of three members. The formation of the groups was based on the following criteria: (a) a lead technology coach who scored a three or better average on the TSPRT, (b) each group had no more than two members who scored an average of less than two on the TSPRT. Overall, a total of 19 participants were targeted to participate in the experimental groups.

Additionally, five experts in technology assisted with the development of the research design. These technology experts consulted with the researcher to identify the skills that each middle school teacher should be able to implement and integrate into the classroom. Using this criteria, as well as e-mails sent to potential participants asking them to identify technology skills they were
interested in learning, a technology curriculum was designed to meet the needs of this experimental PLC.

The PLC groups were formally trained through various sessions and simulations on an assortment of digital media. Informal training also occurred within the individual groups, in the form of e-mail communications, impromptu training sessions, and verbal or non-verbal contact. Additionally, these training sessions were differentiated in order to meet the specific learning needs of each group.

Teachers were interviewed throughout the collaborating and cooperative process. Additionally, each group continually participated in ongoing surveys which measured feelings, use, and skill in technology.

Deliverables

Deliverable 1: Professional Development Presentation

The researcher delivered a professional development session to a rural special school district in West Tennessee in 2009. The researcher gave a quick overview of the history and use of podcasting and the implementation of the iPod and podcasting in the classroom. The presentation encouraged the participants to form a PLC with their colleagues which would further promote self-efficacy through various forms of technology.

Deliverable 2: Digital Blog

The researcher submitted the research questions as well as collected data in statistical form to the website www.teacherlingo.com. A portion of this website
can be accessed using the following url:


This digital blog was created because it easily shared compressed, digital information from the research via the Internet to anyone who may be interested in the topic. Additionally, the blog hosted a digital chat-board where questions, answers, and comments about the research could be shared with the professional education community.

*Deliverable 3: Compact Disc with Training Materials*

The researcher also provided a compact disc to all participants. The compact disc contained digital resources such as online links to technology resources, PowerPoint presentations with guides, and Word documents containing directions on how to use digital databases and search engine tools.
CHAPTER II

REVIEW OF THE LITERATURE

Introduction

Students are becoming increasingly digital. Opinion Research Corporation estimated that three-quarters of all households in America own computers (Slocombe, 2005). Research by Subrahmanyam, Greenfield, Kraut, & Elisheva (2001) revealed that 36.6% of all American households with children aged eight to seventeen have access to the Internet. When this same age group was questioned as to what medium they would most want to bring to a deserted island, more students chose a computer with Internet access than any other form of technology (Rideout, Foehr, Roberts, & Brodie, 1999).

While approximately 99% of all teachers in the United States have some access to the Internet for classroom use, only about 36% of these classroom teachers reported using computers and the Internet for classroom learning (National Center for Educational Statistics, NCES, 2000 & 2006). Less than 10% of these teachers use the Internet to obtain lesson plans, information on best practices, or educational research (NCES, 2000). However, teachers with the most professional development within the last three years were found to assign more types of work that utilized computers or the Internet (NCES, 2006).
Partial blame for this lack of preparedness or hesitation to use technology in the classroom, despite access, may rest on the fact that the majority of classroom teachers receive five hours or less of technology training per year (McKenzie, 2001). Other barriers include the fact that many teachers feel a lack of professional support to learn and implement technology within their teaching environment. Some teachers with less technological training express emotions of fear and apprehension when faced with the challenge of learning new forms of technology.

Recent research has shown that the most effective method for teachers to learn these needed technological skills is through a support system within the school (McKenzie, 2001). This system operates best when it is composed of fellow teachers who share a common goal. These goals are most successful when the support system, referred to as a professional learning community (PLC), works cooperatively to continuously seek professional development that is beneficial not just to individuals but to the entire learning community (Hord, 1997).

The following questions guided the review of related, scholarly literature:

1. What is the technological skill and use level of the teacher population in the studied environment?
2. What are the barriers inhibiting technological use in the middle school classroom?
3. To what extent will a PLC environment encourage the use of technology?
Technology: Students and Teachers

Today’s Student.

Today’s student can be described as one who has substituted the laptop and the Tablet PC for pencil and paper, the E-Book for the textbook, interactive presentation tools for the chalkboard, a GPS system for the globe, the LCD projector for the opaque projector, and the DVD for 35mm movie or filmstrip. Students no longer have to be reluctant to answer questions posed in the classroom and fear a peer response because they can now use E-Clicks or digital classroom response systems that can be coded by the teacher in order to protect identity. Today’s student is digital. Today’s student thrives and learns as no previous generation.

With the rise of the Net Generation, or the generation of students who will have no knowledge of time before the Internet, comes a host of learners who demand all things digital. Prensky (2001) described the arrival of the Internet as a singularity or an event that has so fundamentally changed society that there is no regression to the ways of previous time. The students who were born during this era will always be accustomed to media that is digital in nature. This ubiquitous presence of technology includes but is not limited to video games, computers, cellular phones, digital cameras, instant messaging, and increasingly faster and more efficient access to the Internet.

Those who are part of this generation are commonly referred to as the N-Gen (Net Generation) or the D-Gen (Digital Generation). They are the native
speakers of all things digital in language (Prensky, 2001). These Digital Natives are in stark contrast to what Prensky refers to as the Digital Immigrants, or those who were not born into the digital world but have attempted to adopt or at least accept digital society. The difference between these two groups is that the Digital Immigrant has a distinct *accent* that sets him or her apart from the Digital Native. While the Digital Native has perfected and acquired the advancing language of the digital world, the Digital Immigrant struggles to adapt in an environment that expects full emersion into a digital society. In many situations, due to generational age differences, the Digital Native is left under the tutelage of a Digital Immigrant who struggles to speak a foreign language. Prensky insists that the single biggest problem facing education today is that our Digital Immigrant instructors, who speak an outdated language (that of the pre-digital age), are struggling to teach a population that speaks an entirely new language.

Tapscott (1998) claimed that the Net Generation is an echo of the Baby Boom. He described them as some 88 million students across the United States and Canada who are the digital masters of social transformation. Their lifestyle is part of the *digital revolution* in which N-Geners aged 0-20 embrace all things digital. Tapscott suggested that they are culturally supreme to the Baby Boomers in the fact that they adapt, accept, and gather information in a focused and self-reliant manner. All aspects of the N-Geners lifestyle, including the way they shop, play, communicate, and learn, are digitally shaped.
Tapscott (1998) described a paradigm shift in learning from broadcast learning to interactive learning for this generation of students. He described broadcast learning as that which is hierarchical with a top-down distribution. This type of learning is the setting in which the Baby Boomer was educated. It is generally non-interactive and leaves the learner with no real power to make decisions about how he or she received learning. Tapscott urged that this type of teaching and learning is dated and contrasts starkly with the most effective style of learning for N-Geners, interactive learning.

Tapscott (1998) described interactive learning as learning in which the student shares the power of learning with the instructor through digital media such as computers and the Internet. The interactive learner is one who learns with customized lessons through hypermedia like the Internet. Tapscott wrote that the N-Gen student is able to “synthesize, not just analyze.” (¶ 28) These students are able to engage with digital information and digital media in a higher-order fashion than those outside their generation. In interactive learning the teacher works as the facilitator of learning instead of the transmitter of all learning. Tapscott suggested that when today’s student is given the opportunity to learn in an interactive learning environment, he or she is much more motivated to learn. However, Tapscott insisted that the teacher is still essential to this learning process in order to provide structure for the learning experience.
The Impact of Technology on Student Attitude, Achievement, and Development.

In 1999, the Milken Exchange on Education Technology released a study on the most current research on students and technology at that time. The first study reviewed by the Milken Exchange was James Kulik’s meta-analysis study which aggregated findings from over 500 other research studies which focused on computer-based instruction from elementary schools all the way to adult education. Kulik’s (1994) study found that students who were taught via computer-based instruction scored in the 64th percentile on achievement tests as opposed to the same students in a controlled condition who scored at only the 50th percentile. Kulik also found that all students learned more in less time when they received computer-based instruction and that these same students developed more positive attitudes toward learning and their classes when given the opportunity to use computers for instruction. Kulik also reported the negative finding that computers did not have positive effects in all content areas studied.

Sivin-Kachala’s (1998) research was also a summative study of approximate 219 research studies that assessed the effects of technology on learning and student achievement across all learning areas and age groups. Sivin-Kachala’s study found that students who were learning in technology-enriched environments showed positive gains in achievement in all major content areas. General education and special needs students who were exposed to technology matriculated at higher rates than those who were not frequently exposed to technology-rich learning environments. It was also found that
attitudes toward learning as well as the student’s self-concept were greatly improved when technology was used in the learning process. Sivin-Kachala also reported the inconclusive finding that the level of effectiveness in educational technology was greatly influenced by the specific student population in relation to the teachers’ roles, as well as software design and level of student access to the technology.

In 1994, the program Apple Classrooms of Tomorrow (ACOT) was created to address the impact of technologies and learning in five school sites across the nation which included the states of California, Tennessee, Minnesota, and Ohio. The goal of ACOT was to support teachers while emphasizing the importance and potential of computers in the classroom, to encourage instruction that included technologies, to encourage cooperative learning, and to instruct teachers and students on how to access various resources. (ACOT, 2002)

The ACOT study showed the following positive findings. First, ACOT found that their program led to learning experiences that required higher-level thinking skills as well as problem-solving skills. ACOT found that student attitudes toward learning improved when technology was used in the classroom. Stand-up lecturing time decreased as teachers found ways to create interactive lessons that were more student-centered. Negative findings included the fact that these students did not perform any better on standardized testing involving math concepts, vocabulary, and reading comprehension than comparison groups who did not have access to the ACOT program. (ACOT, 2002)
In 1999, a study of the state of West Virginia’s Basic Skills/Computer Education (BS/CE) program which examined a sample of 950 fifth-grade students’ achievement scores across the state (Mann, et al., 1999). Data were also collected from 290 teachers to measure the influence that West Virginia’s Integrated Learning System technology had on student achievement. The system focused on teaching spelling, vocabulary, reading skills, and math.

The following positive findings on the BS/CE program were found. With increased frequency of use of the BS/CE program came increased test scores on the Stanford 9 test. Lower-achieving students showed the most growth on the Stanford 9 test. The attitudes of both students and teachers were more positive toward technology with increased training on the BS/CE program. Approximately half of the teachers felt that the technology provided by the BS/CE program assisted with West Virginia’s instructional goals and objectives. These same teachers also reported that they felt more enthusiastic about technology due to training in the BS/CE program. It was also found that the BS/CE program was the most cost-effective in approving student achievement over decreasing class size, increasing instructional time, or cross-age tutoring programs. There were no negative findings reported.

Wenglinsky’s (1998) study assessed a national sample of 6,227 fourth-graders and 7,146 eighth-graders and the effects of simulation and higher order thinking technologies on mathematics achievement on the National Assessment of Educational Progress (NAEP). The researcher took into account socioeconomic
status, class size, and various teacher characteristics. He attempted to account for all relationships between technology and educational outcomes reported by the value added by technology for classes of comparable groups of students, in comparable class sizes, with comparable teachers.

Wenglinsky reported the following positive findings. Eighth-graders who were using the simulation program and higher-order thinking software showed gains in math scores of approximately fifteen weeks above grade-level according to the NAEP. Teachers of these same eighth grade students receiving professional development training on various forms of technology had students who showed gains in math of approximately 13 weeks above grade-level. It was also found that this professional development and the higher-order use of computer skills were directly, positively related to student achievement in math for both fourth grade and eighth grade students. Negative findings of Wenglinsky’s study included the fact that fourth-grade students using this technology program which utilized educational games and higher-order thinking only performed three to five weeks above grade-level as compared to those students who did not participate in the technology-enriched teaching program.

Scardamalia and Bereiter’s (1996) study examined collaborative computer applications in schools. The study found that students with this instructional form of technology outperformed other students in control classrooms in measures of depth of understanding as well as reflection. These same students also scored higher than their control counterparts on standardized tests in reading, language,
and vocabulary tests. The treatment students were found to be more advanced in progressive thought patterns and more independent thinkers than those students who did not participate.

The Milken Exchange on Education Technology (1999) produced the following general conclusions on student attitude, achievement, and development. Most students, as well as teachers, showed an improved change in attitude when exposed to learning that included technology integration. Most students performed better on standardized tests than those who did not receive educational instruction that utilized technology in the learning process.

Since the time of the Milken Exchange study, several other experts in the field of technology and student learning and achievement have published similar findings. In 2002, the ACOT program produced another study of the impact of technology on student achievement. This updated study found that students with routine access to technology learn basic skills faster and more easily than those students without access to technology. ACOT found that a result of using technology to learn basic skills was that students spent more time learning and practicing these basic skills than those students who were taught using a traditional approach. ACOT also found that at-risk students were shown to have significant improvement in all content areas when technology is implemented into the classroom. ACOT reported that students were motivated and excited to learn more when technology was used as a daily part of the curriculum. ACOT studies also stated classrooms which use technology have students who interact
more often with both peers and teachers than those students who learn in more traditional classrooms.

The ACOT (2002) study suggested that the most important finding in their research is the contribution that technology makes toward the student’s learning attitude. The study suggested that the use of technology in the classroom is directly related to a lower drop-out rate. When Apple Computer Incorporated compared their ACOT classrooms to those non-ACOT classrooms in the same school, absenteeism in the ACOT classrooms was about half that of the non-ACOT classrooms. ACOT students of secondary schools were found to complete high school at higher rates than non-ACOT students. These students also entered colleges at higher rates than non-ACOT students.

ACOT researchers (2002) concluded their findings as the following: Students with few economic advantages learn basic skills faster and better with technology. Technology acts as a tool that encourages and engages students. Students in technology-rich learning environments are able to communicate more clearly and more powerfully than those students who are not in technology-rich environments. Also, students who use technology to create assignments take more pride in their work and develop higher levels of self-esteem related to learning than those students who do not use technology to create assignments.

In 2008, Apple Computers published yet another study that focused on the goals that should be set in order for students to be successful in the 21st
century. The Apple Classrooms of Tomorrow Today (ACOT²) reported that students perform best and will perform best in the future when offered ubiquitous access to technology. Additionally, ACOT² has identified six design principles for the 21\textsuperscript{st} century high school. These include:

1. Understanding of 21\textsuperscript{st} Century Skills and Outcomes: A baseline of technology skills must be established for educators, students, and parents in order to make students successful.

2. Relevant and Applied Curriculum: An innovative vision of what the learning environment should be by applying innovative technology to pedagogy.

3. Informative Assessment: Assessment used to assist students in monitoring their own learning.

4. A Culture of Innovation and Creativity: A learning environment that generates the continuous development of technology related skills.

5. Social and Emotional Connections: Specifically, each student having a clear connection to the social environment of the school.

6. Ubiquitous Access to Technology: Technology plays an essential role in the development and preparation of the 21\textsuperscript{st} century student. (pp. 11-12) (Figure 1).
Figure 1. Six design principles.

Technology and the Teacher.

Experts in staff development have been tracking the use and implementation of technology in the classroom for over 20 years (McKenzie, 2001). However, the rate at which teachers adopt and implement technology into the classroom varies greatly from teacher to teacher. Noon describes this assimilation in four stages. Stage 1 teachers are considered preliterate end users (as cited in McKenzie, 2004). These teachers have little to no experience using technology or computers. Most of these teachers lack the proper professional training or have not become interested in implementing technologies. Noon explains that this group of teachers needs to have the benefits of technology
pointed out; they need to know how technology can directly benefit them by managing classroom tasks, decreasing paperwork, and assisting in record keeping. Noon describes the Stage 2 teachers as those “software technicians” who already use computers and common technology applications. Many times these teachers use the internet for sending and receiving e-mails, surfing the Web, word processing, and storing some forms of digital data. The Stage 2 teacher does not directly integrate computers into the curriculum but is at a point where he or she ready to be introduced to the notion that technology can be a useful skill for learning. The Stage 3 teacher is an electronic traditionalist who is proficient in using technology in the classroom. Noon stated that although this teacher is very proficient, he or she uses technology in the most traditional sense of education. When technology is utilized, it is only in the form of electronic grade books, quizzes, tests, drill and practice software, and digital lesson plans. Noon suggested that the Stage 3 teacher discover new options for technology use in the classroom such as virtual field trips, online projects, Webquests, and distance learning. Noon described the Stage 4 teacher as a *techno-constructivist*. This teacher is savvy in integrating technology into the curriculum so that it not only compliments the lessons but also enhances it to a point that the lesson would not exist if it were not for the form of technology being used. This Stage 4 teacher has matriculated through all of the previous stages of technology adoption and has realized the full potential of technology in
the classroom not only for personal use but also to assist their students in the
discovery of education (as cited in McKenzie, 2004).

Hooper and Reiber (1995) described the adoption of technology by
educators in five phases. These five phases include Familiarization, Utilization,
Integration, Reorientation, and Evolution. In the Familiarization phase, teachers
are introduced to new technologies and begin to experience a new form of
technology. Most of the time, this stage is experienced in workshops and
professional development seminars. Hooper and Reiber explained that the
problem with this stage of technology use is that the experience usually ends
when the workshop or the professional development ends. Though the new idea
has been presented, there is no follow-up or extended training to reinforce this
new learning. Thus, many teachers quickly abandon the use of new forms of
technology. Hooper and Reiber stated that “all that remains [of this
familiarization phase] is a memory of the experience” (p. 156).

According to Hooper and Reiber (1995) the second phase is the Utilization
phase. In this learning phase the teacher attempts to use a new form of
technology in the classroom. This teacher is described as one who will
prematurely settle for his or her limited use of technology. Often this teacher will
take the attitude of “at least I gave it a try,” and will quickly discard the use of
new technology in the classroom at the first sign of trouble. This lack of trouble
is usually due to a lack of commitment and dedication to fully using technology.
Hooper and Reiser stated that this is the highest phase obtained by a majority of teachers in the classroom.

The third phase described by Hooper and Rieser (1995) is the Integration phase. In this phase the teacher comes to a break-through in which he or she realizes that if the technology were taken away, the lesson could not proceed successfully in the classroom. The Integration phase is commonly misinterpreted as the highest phase in the adoption of the technology sequence; it is described by Hooper and Rieser as just the beginning of a professional metamorphosis.

The fourth phase as described by Hooper and Rieser (1995) is the Reorientation phase. This phase requires the educator to form new concepts as to the function and purpose of technology in the classroom. This phase becomes a reorientation of the focus of the classroom on the student’s learning instead of the teacher’s instruction. Hooper and Rieser described this teacher as one who is open to new forms of technology in the classroom that enable the construction of knowledge and who is not threatened by technology as a replacement of the teacher. Often, these teachers may not be completely proficient in the form of technology that they are utilizing in the classroom, but they are not afraid to try and learn side-by-side with their students. This teacher is more concerned with the level of engagement by students and less concerned with his or her own technological proficiency.

The highest phase of the technology adoption process described by Hooper and Reiser (1995) is referred to as the Evolution phase. In this phase,
teachers recognize that the ways in which they teach and use technology must continually evolve and adapt in order to remain effective. These teachers recognize that there will never be a final solution or conclusion for integrating technology in the classroom.

Hooper and Reiser (1995) stated that the traditional perspective of educational technology focuses on either the technology itself is limited to the first three phases of the described model. However, the contemporary perspective of educational technology in the classroom is more focused on the learner’s active construction of knowledge, and should reach all the way to the Evolution phase without being hampered by the often stagnant Integration phase.

Teacher Use of Technology.

Over the past few decades there have been numerous strides taken to introduce technology into the classroom. Yet data still show that many classrooms are deficient in the use and integration of technology. The No Child Left Behind law states that all students should be proficient in technology by the time they leave the 8th grade; there is no statement as to how technology-literate their teachers should be (U. S. State Department of Education, 2007). While 95% of schools and 72% of classrooms report having Internet access in the classroom, 86% of teachers report using the Internet for e-mails and only 66% use the Internet to find curriculum ideas. A mere 30% use the Internet for
student research, and only 16% employ the Internet as a tool for lesson planning (Bryant, 2000).

Mumtaz (2000) cited several factors that explain the disparity between the availability and use of technology in the classroom. These factors include lack of experience teaching with technology, lack of on-site support encouraging the use of technology, lack of help supervising students when using computers, a lack of technology instructors in the school building, lack of computer availability in the school, a lack of financial support to fund technology, and a lack of time required for teachers to learn new forms of technology. Mumtaz explained that any combination of these factors can prevent teachers from successfully integrating technology into the curriculum.

Starr conducted interviews with the 35 members of Education World’s Tech Team in 2000 to uncover the roadblocks to the information highway. Starr was interested in why the level of classroom technology use was not as fast growing as the availability of technology. One of the greatest factors that was uncovered as an impediment to technology was lack of time for new technology training as well as lack of time for learning new forms of technology. A Webmaster for a school in Nebraska, stated that when there is staff development opportunities in technology “there is frequently no follow-up or reinforcement” (Starr, 2000, ¶ 12) after the training. Another teacher believed that collaboration between teachers with technology experience is the key. This same teacher stated in her interview that “many teachers just need someone to show them
that it can be done. Or they need an extra pair of hands and eyes” (Starr, ¶ 12) to assist them in learning and integrating technology. A librarian stated in her interview that “the most significant impediment to integration of technology into the curriculum is staff development” (Starr, ¶ 13). A science teacher said in his interview that “a lack of teacher training is the greatest impediment to technology training” (Starr, ¶ 13). Additionally, this teacher adds that each school system needs a “plan” that includes collaboration between teachers in order to make the training successful. Another teacher believed that much of the reluctance that prevents teachers from using technology is “based on intimidation due to fear” (Starr, ¶ 14). According to this same teacher, the solution to this fear is “staff development” (Starr, ¶ 14). Another teacher stated that “technology integration must be the vision of all involved,” and noted that “with support, collaboration, and training, teachers will see the benefits of technology integration instead of seeing it as something more they have to do” (Starr, ¶ 15).

Starr’s (2000) interviews led to the following conclusions about teachers’ use and implementation of technology in the classroom. First, educators need plenty of time to develop, use, and learn technology. They need time to reformat their existing lessons to include technology. They need time to search the Internet to supplement existing lessons and to share and collaborate with colleagues about how to use technology. Second, educators need training in technology. They need to be trained in the use of various hardwares and
softwares as well as ways to integrate technology into the curriculum in classroom management. Finally, teachers need good mentors and teams with which they can collaborate with. They need a team of other educators who can give them the confidence to learn new technologies and with who they can brainstorm about ways in which to use technology. These teams are needed to complement and encourage innovative pioneers in schools who attempt to use new technologies. Educators need supporters who will praise their dedication and successes in learning and implementing technology to enhance classroom learning. The interviews conducted by Starr found that the key to meeting all of these needs is the motivation to do so.

In 2008, ACOT\(^2\) and The Partnership for 21\(^{st}\) Century Skills developed a diagram expressing the milieu in which educators are forced to operate in order to reflect the rainbow of skills and outcomes of successful 21\(^{st}\) century students. Teachers must continually meet the stressful demands of standards and assessments, develop curriculum and instruction, continue their professional development, and create a welcoming and positive learning environment. In addition to meeting the aforementioned demands, teachers must also ensure that their students develop life and career skills, learn new media and technology skills, understand 21\(^{st}\) century innovations, and master their core subjects (Figure 2).
Figure 2. P21 framework for 21st century skills

Teaching Teachers Technology

McKenzie’s (2001) research found that the most effective learning strategy for teachers in learning technology was to change how teachers work together to achieve a common goal. McKenzie found that informal support systems, partnerships, teams, and collaborative structures brought the most broad-based changes in how teachers learn and adapt to new technologies. McKenzie found that most teachers often felt isolated from one another and actually preferred to be grouped with other teachers with the skill and confidence to assist in learning new technologies. The key to success in this learning process was the recruitment of those teachers who already had not only the skills and confidences to learn technologies independently but who could also transfer this knowledge to teachers who were in need of learning. Additionally, McKenzie
found that the best progress was made when skilled partners worked alongside those with novice skills throughout the implementation and development stages of learning new technology.

Research by Weiss (1994) indicated that the most effective factors in maximizing the benefits of education through technology include:

1. Extensive teacher training in the integration of technology into the curriculum.
2. Active participation by teachers in learning activities that teach technology to teachers.
3. A collaboration of teachers working together in order to learn new technologies. (Weiss, p. 30)

Professional Learning Communities

Defining the Professional Learning Community

The term *Professional Learning Community* (PLC) has been defined by Morrissey (2000) as a "school that operates as such that it engages the entire group of professionals in coming together for learning within a supportive, self-created community" (p. 3). The PLC is defined by Wald and Castleberry (2000) as a group of professionals within a school who share a common vision for their students, staff, and administration that is achieved through shared collaboration. The term *professional learning community* as described by Hord (1997) is a collegial group of administrators and school staff who are united in their commitment to student learning. They share a vision, work and learn
collaboratively, visit and review other classrooms, and participate in decision making (Hord). Benefits include a reduced isolation of faculty, a group of committed teachers who are better informed, and academic gains for students. Hord noted, "As an organizational arrangement, the professional learning community is seen as a powerful staff-development approach and a potent strategy for school change and improvement" (p. 12).

Hord (2004) identified five primary characteristics that define the PLC:

1. Supportive and Shared Leadership: The support and shared leadership of administration, inviting staff input toward decision-making.

2. Shared Values and Vision: A commitment to student learning that is expressed through staff work and professional development.

3. Collective Learning and Application of Learning: All levels of school staff are engaged in a process that actively seeks new knowledge that will address student needs.

4. Supportive Conditions: The physical, emotional, and mental conditions that continually encourage and support a collegial atmosphere with collective learning.

5. Shared Practice: A review of teacher’s behavior by colleagues that involved positive feedback and assistance that supports both individual and PLC improvement. (p. 7)
DuFour and Eaker (1998) defined the PLC with six characteristics:

1. Shared Mission, Vision, and Values: These principles are “embedded in the hearts and minds” of all members of the school; these characteristics are integral to the PLC.

2. Collective Inquiry: Members of a PLC will continually question the status quo, seek out and test new methods of learning, and thoughtfully reflect on the results. Collective inquiry will give the PLC the ability to examine, modify, and transform their beliefs so that they will make significant changes in the “culture of their organization.”

3. Collaborative Teams: This group shares a common purpose. Though individual growth is important, it does not always lead to organizational growth; the collaborative team engages in team learning that is reciprocal and leads to continued PLC improvement.

4. Action Orientation and Experimentation: Members of a PLC turn “aspirations into actions.” They are intolerant of lackadaisical behaviors that are impeding toward the goals and visions of the PLC. Additionally, members of the PLC test theories, develop their own theories, and evaluate the results. The result is a capability to learn, relearn, and begin again with increased knowledge.

5. Continuous Improvement: Members of the PLC do not see continuous improvement as a “task” or “project that must be completed.” Rather, they see continuous improvement as necessary. They realize and
celebrate in the fact that the visions and goals of the PLC may never be fully realized due to continuous improvement.

6. Results of Orientation: The PLC realizes that valid assessment of their efforts toward a common goal, shared vision, and values are based on results and not intentions. The PLC strives to incorporate ongoing assessments that produce tangible results. (pp. 25-29)

The Supportive Culture of the PLC

A form of collaboration between educators that has proved to put teacher learning first and create a supportive learning culture is the PLC (Morrissey, 2000). The PLC offers teachers an opportunity to work with colleagues who are seeking similar goals. The PLC is one that meets together to set goals and share strategies for various aspirations (DuFour, Eaker, & DuFour, 2005). DuFour and Eaker (1998) cited that in a PLC “educators create an environment that fosters mutual cooperation, emotional support, and personal growth” (p. xii) in order to work collaboratively to achieve together what they could not achieve individually.

Hord (1997) identified two types of supportive structures that compose the PLC: structural conditions and collegial relationships. The structural condition of the PLC is composed of the size of the school, the process of staff development, the use of time, the proximity of the teachers and staff involved, and the procedures for communicating. The collegial relationship is composed of positive educator and administration attitudes; a widely shared vision of the goals that are to be accomplished by the PLC; constructive criticism toward the
inquiry and development of the PLC; and respect, trust, shared values, and caring relationships between members of the PLC.

Technology and the Professional Learning Community

Garcia (2005) believes that combining educational technology with the PLC could lead to the development of collaborative learning environments that will sponsor and maintain the integration of technology and enhance the educational experience of both students and teachers. Garcia points to the Internet as a medium for the PLC to utilize to improve student learning. Garcia’s examination of the Tapped In program (an online continuous PLC) and the Maryland Electronic Learning Community revealed that teachers were able to “reflect on practice, experiment, share pedagogy, and support each other” (¶ 2). Garcia cited that teachers who are part of PLCs are able to learn technology from one another and grow as professionals because of the ongoing support and development that the PLC offers. Garcia stated that teachers who are part of a PLC often feel validation and support while learning technology because they feel that they are part of an innovative learning environment.

The Southwest Educational Development program (SWED) found that the two-year professional development program for teachers known as Applying Technology to Restructuring and Learning (ATRL) resulted in a majority of the participants’ classrooms becoming deeply imbedded in the use of technology for pedagogical learning (Garcia, 2005). ATRL targeted low or at-risk schools and sought to assist teachers in creating learning environments that were supported
by technology. The project focused on creating PLCs of educators who were in need of learning various technological skills with the hope that once strengthened with the knowledge of technology, the educators would integrate technology for learning in the classroom at a higher rate (Garcia). The program associate of SWED, found a 62% increase in collegial discourse and a 65% increase of student work due to the learning of technology by teachers through this PLC model. The program associate of SWED noted that the model itself focused less on how educators teach and more on how educators learn as a means to increase the integration of technology into the classroom (Garcia).

Conclusions

Today’s educators are faced with teaching a generation of Digital Natives while they themselves are often categorized as Digital Immigrants. There is not necessarily a lack of willingness to teach to this generation but rather a lack of knowledge as how to integrate technology into the classroom. Several barriers include lack of time for learning new technologies, lack of on-going professional support, and a need for organized collaborative learning groups. These barriers often impede the teacher’s ability to successfully learn and integrate technologies into the classroom. A solution lies in the formation of a Professional Learning Community of educators and administrators who share a common goal and a vision for teachers to learn technologies that can be implemented to enhance and manage classroom learning.
CHAPTER III

METHODOLOGY

Introduction

Today’s secondary student is one who is often referred to as part of the “Internet Generation” or the “N-Gen” in reference to a group of learners who were born after the creation of the WWW (Prensky, 2001). Prensky further states that these learners speak a language that is purely digital. Prensky refers to them as the “native speakers” of all things digital. Tapscott (1998) identifies this generation of learners as one whose culture and methods of interactive learning have been shaped by an emerging “digital media culture” (Tapscott, ¶ 5). It should be no surprise that the method in which these students most enjoy learning is also through the use of varied digital media.

The dilemma in educating these students through the use of varied digital media stems not from a lack of willingness to teach to this “Internet Generation,” but from the teachers’ lack of up-to-date technological training and preparedness. Several factors (e.g., experience teaching with technology; on-site support that encourages the use of technology; sufficient assistance in supervising students when using computers; technology instructors in the school building; computer availability in the school; financial support to fund technology; and time required for teachers to learn new forms of technology)
help explain the disparity between the availability of classroom technology and the failure to use it have been identified by Mumtaz (2000). In addition, Mumtaz explains that any combination of these factors can prevent teachers from successfully integrating technology into the curriculum.

McKenzie (2001) found that the most effective learning strategy for teachers to learn technology was to encourage teachers to work together toward common technological goals. These technology goals may be reached through a PLC Hord (1997) describes as a collegial group of administrators and school staff who are united in their commitment to student learning. The PLC is one that meets together to set goals, and share strategies for various aspirations. DuFour and Eaker (1998) cite that in a PLC “educators create an environment that fosters mutual cooperation, emotional support, and personal growth” (p. xii) in order to work collaboratively to achieve together what they could not achieve individually. Teachers who are part of PLCs are able to learn technology from one another and grow as professionals because of the ongoing support and development that the PLC offers (Garcia, 2005).

An exhaustive review of research literature revealed that teachers who lack knowledge and skills in the areas of technology use and integration into the classroom were most likely to benefit from a system of PLCs. Earlier research (DuFour et al., 2005) suggested that teachers of secondary students would benefit most from training sessions in technology that were designed to be collaborative and cooperative.
Thus, three questions drove this research:

1. What is the technological skill and use level of the teacher population in the studied environment?
2. What are the barriers inhibiting technological use in the middle school classroom?
3. To what extent will a PLC environment encourage the use of technology?

Research Design

The researcher engaged the use of a scientifically-based research design to conduct research to train teachers in technology through the PLC. This type of research has been described as one that allows the researcher to identify a research need, implement a treatment, actively gather data, analyze the data, and then report on the data findings (Gay, Mills, & Airasian, 2006). This mode of research was easily applicable to the secondary teaching environment in an engaging and manageable fashion. This type of research specifically allowed the researcher to invite members of an intact middle school faculty to take part in hands-on technology learning sessions in the PLC setting in order to encourage the additional use and knowledge of technology.

The researcher compiled a mixed-model of quantitative and qualitative data for each participant, which was then triangulated for verification purposes. Gay et al. (2006) suggest that researchers use the practice of triangulation in order to verify collected data in various forms in an effort to create a system of
checks and balances. This method of data collection allowed the researcher to use qualitative surveys in order to elaborate on responses on quantitative pre- and post-tests.

Fowler (2001) stated that the purpose of using a survey to supplement research is to produce statistics related to the population by random sampling without having to interview an entire population. Survey data serves to assist the researcher in collecting subjective data from the participants of a study that may not otherwise be recorded. Often survey data can reveal hidden feelings, assumptions, and opinions about the research, especially when those who participate have an interest in the research itself (Fowler). The weakness in using survey data is often found in the form of bias, non-participation, intentional question elimination, and poor question design (Fowler, 2001). Because survey results, standing alone, do not provide sufficiently reliable results, surveys comprised only one component of the mixed-model approach implemented by the researcher in this study.

The mixed-model approach helps ensure a more thorough ultimate analysis. As Kubiszyn and Borich (2003) stated, while quantitative data are statistically useful and provide important numerical information, they are limited by their failings to explain why discrimination distracters occur in the research process. Conversely, qualitative data, standing alone, does not produce a significant amount of objective statistical data. Thus, research suggests that for a researcher to do thorough analysis, the researcher must use a combination of
both quantitative and qualitative methods without relying too much on either form of research design (Kubiszyn & Borich).

For these reasons, the researcher implemented a quasi-experimental research design, which has been described as a mixed model of experimentation that allows the researcher to assign participants randomly to homogenous groups using intact participants (Gay et al., 2006). This type of design allows the researcher to make “casual inferences about the effect of an intervention where the total absence of control makes scientific conclusions impossible” (Campbell & Stanley, 1966, p. 78). Campbell and Stanley recommended quasi-experimental design for research in a “natural setting,” where a “true experimental design” (p. 81) is often impossible, as the researcher does not have full control over the stimuli.

The process to conduct research began by submitting the research proposal to Trevecca Nazarene University’s Institutional Review Board. The research proposal included the research design, instruments, and consent forms (see Appendix B). Following the approval of Trevecca Nazarene University’s Institutional Review Board (see Appendix C), a letter of support from the school building’s local administration (see Appendix D) along with the Institutional Review Board letter (see Appendix A) were submitted to the school district in which the study was conducted. With approval from the school administration and Trevecca Nazarene University granted, the research investigation began.
Population

This research was conducted in a large, suburban middle school in Middle Tennessee. This school district was well-funded and provided a multitude of technological advances, which were at the disposal of the participating teachers as well as the researcher who implemented the treatment.

The student body of the school in which the research was conducted was primarily Caucasian; approximately 98% of the student body fit into this category while the remaining 2% of the student body would be considered part of a minority race. Thus, the participating teachers reflected similar ethnic demographics.

Thirty-one teachers participated in the study. Prior to conducting this investigation, the participants were asked to consent to participate and share demographic data with the researcher (see Appendix B).

The participating teachers taught grades ranging from sixth to eighth, with some teaching at multiple grade levels within this range, and taught all ranges of content-area subjects, related arts studies, and guidance. The participating teachers ranged from 22 to 64 years of age. Their education levels ranged from Bachelor’s degrees to Educational Specialist, as recognized by the State of Tennessee, and their years of service in education ranged from $1 \frac{1}{2}$ to over 40. The treatment group contained 19 participants, three of whom were male, and 16 of whom were female. All participants in the treatment group were Caucasian. The non-treatment group was composed of 12 participants, five of whom were
male and seven of whom were female. Of the male non-treatment participants, one was African-American while the four remaining males were Caucasian. All of the females in the non-treatment group were Caucasian.

Data Collection

The collection of data for this research began in August of 2007, with the researcher providing a demographic screener to all willing participants. The screener contained questions addressing level of education, years of teaching service, age, gender, ethnicity, current teaching grade-level, perceived level of technology ability, and an open-ended screener seeking the specific technology skills that participants would like to learn over the course of the study. After this demographic screener was completed, the researcher gave participants the Technology Skills Pre-Assessment Test (TSPRT), created by Johnson (1995 & 2007) (see Appendix A). Mr. Johnson has authored numerous articles and a book on technology, appeared in many academic compilations concerning technology, and has spoken on educational technology at over 130 conferences. The internal consistency and construct validity of the Technology Skills Pre/Post-Assessment Test has been authenticated by research that states that the tool can “legitimately [be] used as part of professional development for grouping participants by level of competence to obtain maximum results from training” (D’Onofrio & Bowes, 2005, p. 1).

The Technology Skills Pre-Assessment Test included 14 questions pertaining to technology. Each question included a rating of 1 - 4 in a Likert-style
scale that contained a rubric fully explaining the level of each response. The questions addressed basic computer operations, file management, time management and organization, word processing, spreadsheet use, database use, graphics and digital image use, hypermedia presentation software, network and internet use, student assessment with technology, ethical use of technology, e-mail and electronic mailing lists, search tools and evaluation strategies, and webpage construction. Completion of this pre-test was finalized at the end of August, 2007.

Using the participating teachers’ subjective responses on the pre-test, the researcher then ranked the participants as: novice (1), intermediate (2), proficient (3), or advanced (4). Using these identifiers, the researcher created homogeneous treatment and non-treatment groups. The non-treatment group, composed of 12 members, did not participate in the professional learning community, while the treatment groups received the technological training via a PLC.

After identification, treatment participants were grouped into heterogeneous PLCs based on their Technology Skills Pre-Assessment Test (TSPRT) scores (see Appendix A). Each PLC consisted of either three or four members. The formation of each PLC was determined by the researcher based upon the following criteria: (a) each PLC was assigned a lead technology coach who scored a three or better average on the TSPRT, and (b) no more than two members per PLC who scored an average of less than two on the TSPRT.
Overall, four four-member PLCs and one three-member PLC were formed, with a total of 19 participants targeted to participate in the treatment groups.

Five technology training sessions were held. Topics included: the management of e-mails, computer shortcuts, use of search engines, digital databases, and Excel tips. The sessions commenced at the conclusion of the professional work day in the school’s computer lab. Each session lasted for approximately 35 to 45 minutes. Each technology training session was led by a computer instructor or expert who volunteered his or her time and who was not otherwise a member of the treatment or non-treatment group. After an informational packet pertaining to each session was distributed and a short demonstration was shown, the PLCs were given time to work together on various technological skills.

At each training session, a technology expert, the researcher, and members of the PLCs were present. Each member of the PLCs received detailed handouts with step-by-step instructions to aid him or her in each technology training session. At the conclusion of the research study, the researcher distributed a compact disc to each PLC member, containing a digital copy of every handout and multi-media presentation used in the training sessions.

The researcher was present at each PLC training session, to take notes and distribute the Presentation Feedback surveys (see Appendix I) given at the end of each training session. The Presentation Feedback surveys were adapted from a similar form used by Trevecca Nazarene University’s School of Education.
The Presentation Feedback survey addressed the training in relation to the best practices of the school system, the perceived opportunity to develop knowledge, the perceived opportunity to develop new skills, the perceived effectiveness of the use of technology in the sessions, the level of assistance the training provided teachers to better do their jobs at the school, the applicability and knowledge to practice the skill independently, and the level of the participants’ understanding of the training. Each question on the Presentation Feedback survey contained a Likert-scale rating of 1 – 5, with 1 being the lowest rating and 5 being the highest.

Each PLC member was given an End of Technology Training Reflection/Review (see Appendix H) after the last training session. This reflection/review asked the participants to identify their most beneficial technology training session, what specifically benefited them the most from the training sessions, whether they perceived working in a PLC was beneficial, what they enjoyed most/least about working in a PLC, and whether their knowledge and/or use of technology increased as a consequence of working in a PLC.

Additionally, all participants in both the treatment and non-treatment groups were given a digital survey which inquired about their perceived roadblocks to the use and knowledge of technology. This digital survey was created by the researcher and contained three questions. The first question was a qualitative question which addressed perceived roadblocks to using technology. The second question addressed the frequency of the teachers’ use of technology,
and the responses were reported as categorical data. The final question addressed the participating teachers’ respective anxiety levels when using technology; the responses were reported as interval data. This survey was distributed by and returned to the researcher via the Internet (see Appendix J).

At the end of the research treatment sessions, the researcher re-administered the TSPRT; the results were reported as the Technology Skills Post-Test (TSPST). Both the treatment and non-treatment groups were given the TSPST. All post-tests were returned before the last day of the 2007-2008 school year.

Analytical Methods

The data were collected, organized, and analyzed in this study were both qualitative and quantitative. The researcher used both descriptive statistics and inferential statistical methods to analyze the collected data in this study.

1. What is the technological skill and use level of the teacher population in the studied environment?

A mixed-model analysis of variance (ANOVA) was used to test the difference between the means of the two groups on the TSPRT and the TSPST. This statistical test was used to compare within-subjects and between-subjects comparisons simultaneously.

2. What are the barriers inhibiting technological use in the middle school classroom?
Three questions were posed in the digital survey (see Appendix J). All responses were sorted for themes and reported as qualitative data. The data were reported using descriptive statistics from the individual open-ended responses of the participants.

3. To what extent will a PLC environment encourage the use of technology?

The Presentation Feedback surveys (See Appendix I) used at the end of each technology training session were statistically analyzed using a within-subjects ANOVA test. This method was used because the treatment group was measured more than one time on more than one dependent variable. The qualitative data collected from the End of Technology Training Reflection/Review survey, submitted only by the treatment group, was sorted for themes by the researcher.

Limitations

The researcher encountered various limitations while conducting this study. A primary limitation to this study was the disparity in skill and use level between the treatment and non-treatment groups. Although many teachers initially wanted to participate in the treatment group, very few teachers who scored an average of two or below wanted to be excluded from the technology training sessions and were reluctant to be moved to the non-treatment group. Similarly, many of the higher scoring teachers were reluctant to participate in the treatment groups. Thus, the non-treatment group’s level of technology use and
skill was disproportionately higher than that found in the PLCs. This limitation occurred due to the small sample size that was available to conduct this study.

Another limitation in this study occurred due to the setting of the study. The research was limited to a single computer laboratory and the five PLCs ultimately worked as one large PLC, as opposed to five independent PLCs. Additionally, the participant teachers’ personal relationships with the researcher may have prohibited fully honest and more critical responses to Presentation Feedbacks and End of Technology Training Review and Reflections (see Appendix H).

Various other limitations to the research included: time restraints, participant anxieties, and the possibility of the Hawthorne effect. Teachers who volunteered to take part in the research study did so after the work day commenced and were compensated minimally. Thus, in order to retain participation and interest in the study, the researcher assured that teachers who participated would only be asked to stay one hour per session.

“Participant anxiety” may have inhibited technological knowledge growth from pre- to post-test, as evidenced by certain participants’ perceived anxieties about their levels of ability as compared to other members of the group. Three of the participating teachers who had been teaching for over 40 years scored an average of “1” on the TSPRT. These teachers were timid about fully utilizing the PLC in the training workshops and would often sit apart from the PLC, despite
continual encouragement to join, because they were intimidated by the perceived knowledge of the remainder of the group.

Additionally, the researcher noted the possibility of the Hawthorne effect appearing in the research data. The Hawthorne effect has been described as one in which participants will often provide positive results for data in intervention studies (Wickström & Bendix, 2000). Participants may have purposely and actively provided data that were overly positive in the belief that it complied with the wishes of the researcher. This type of positive data may have been present on the Presentation Feedback Surveys as well as on the TSPST.
CHAPTER IV
FINDINGS AND CONCLUSIONS

Introduction

This study sought to examine how teachers could learn technology through a professional learning community. This study was designed to address the growing need for teachers to learn up-to-date forms of technology in order better to plan, teach, and assess for student learning. The study aimed to bridge the gap between students’ growing knowledge of technology and their teachers’ lack of use and knowledge of technology. The researcher used action-based research to invite members of an intact-middle school faculty to take part in hands-on technology training sessions in the professional learning community setting.

All participants completed the Technology Skills Pre-Assessment Test (TSPRT) (see Appendix A). Using these data, the researcher divided the participants into treatment and non-treatment groups. The treatment group was exposed to five technology skills training sessions. At the end of each training session, the treatment group completed a technology training skills feedback response survey (see Appendix I). After the fifth training session, the researcher re-administered the TSPRT; the results were reported as the Technology Skills Post-Test (TSPST). The treatment group also
participated in the End of Technology Training Reflection/Review after the last training session.

Both the treatment and non-treatment group participants were asked to participate in a digital survey, which addressed the frequency and use of technology as well as teachers’ perceived roadblocks in the use of technology. The researcher then compiled a mixed-model of quantitative and qualitative data for each participant, which was then triangulated for verification purposes (see Appendix J).

Three major questions drove this research:

1. What is the technological skill and use level of the teacher population in the studied environment?
2. What are the barriers inhibiting teachers’ use of technology?
3. To what extent will a PLC environment encourage the use of technology?

Findings

The findings of this research are reported by the research questions that drove the research.

*Question 1: Teachers’ Technological Skill and Use Level*

In order to answer the first question, the researcher had to ascertain the teachers’ knowledge level of technology pre- and post-technology training sessions. Once discovered, the differences were then compared. The researcher compared the treatment and the non-treatment groups using the TSPRT and the TSPST. Mixed-model analysis of variance (ANOVA) tests were used to compare
participants’ pre-test responses to post-test responses on each question of the Technology Skills Tests. Seven of the 14 questions showed significant results either in the within-subjects comparison or the interaction. See Table 1 for descriptive statistics (see Appendix E) Table 2 (see Appendix F) for the $F$-values of these tests.

To follow-up the significant interactions, the researcher ran one-way ANOVAs comparing the two groups for the following questions: Q5, Q12, and Q14. There was a significant difference between the two groups on the pre-test for Q5, $F(1, 29) = 4.89, p < .05$. There was no significant difference between the groups, however, on the post-test, $F(1, 29) = .001$. This may indicate that either the treatment group made significant gains or the non-treatment group declined in their knowledge. For Q12, there was no significant difference between the two groups on the pre-test, $F(1, 29) = 1.39$ or the post-test, $F(1, 29) = 1.09$. However, this may still indicate that gains were made by the treatment group. For Q14, there was no significant difference on the pre-test, $F(1, 29) = 4.47$, or the post-test, $F(1, 29) = .005$. However, this may still indicate that the treatment group did show some gains due to the interaction.

Question 2: Barriers Inhibiting Teachers’ Use of Technology

The second research question was more qualitative in nature. The question sought to discuss and discover teachers’ perceived barriers to learning, using, and implementing technology in the classroom. The data were collected via digital survey, which was open-ended in nature. The responses to the
question were not sorted by treatment or non-treatment group or by the identity of the participant.

The open-ended question on the digital survey simply stated, “In your opinion, what are some of the barriers you face in using technology.” The following themes emerged: time, training, self-efficacy, and funding.

Time. Several participants reported that time was one of the largest factors that prevented them from using, learning, or implementing technology to enhance their teaching. One participant found it “difficult to schedule the computer lab.” Other responses noted a “lack of time to train” on new forms of technology and “not enough time to get the hands-on experience” needed to use technology efficiently and effectively in the classroom.

Training. Another theme that emerged was training. Participants reported poor training, out-dated training, or a lack of opportunity to train. One participant received technology training in a summer session, and reported that the course was too “speedy” and the information that was taught was “not reinforced” with “supplemental” training on the same topic. Another stated that the “training I needed was simply not available through the [school system].” A third participant received technology training in college, but that the training was “now outdated” because of “how quickly technology has changed over the years.”

Self-Efficacy. A minority of participants expressed a great lack of confidence in using technology. For example: one participant was not “confident”
in using a particular form of technology because it was a “new skill;” another felt “too old” to be comfortable using technology; and, one participant had a “fear of doing something that would crash the computer.” Three participants stated they were afraid they would “forget” how to use the technology and this would actually impede instead of assist in classroom learning.

**Funding.** Three participants stated that funding was their only barrier in using technology. One participant stated that the county needed to be “convinced to fund newer, cutting edge types of technology.” Another participant stated that it was both a “lack” of equipment due to funding as well as the funding for technology itself.

**Question 3: Professional Learning Community Encouraging Use of Technology**

The third research question was both quantitative and qualitative in nature. The question sought to determine whether a professional learning community (PLC) would encourage the use of technology and to what extent. The data were collected by two means. The first involved Presentation Feedback Surveys (see Appendix I) which rated the sessions on a Likert scale of 1-5 with one being the lowest rating and five being the highest rating. Within-subjects ANOVAs were run to compare the survey responses of participants in the treatment group. No significant differences were found between the five sessions on any of the seven questions (see Table 3, Appendix G).

Additionally, data were collected via the End of Technology Training Reflection/Review survey (see Appendix H). The responses on the End of
Technology Training Reflection/Review (ETTR/R) were reported as qualitative data. The survey included the following questions:

(1) Which [training] session was most beneficial to you?

(2) What specifically benefited you the most out of the training sessions?

(3) Did you work more in these sessions independently or with others in the PLC?

(4) What do you like most about working in a PLC?

(5) What do you like least about working in a PLC?

(6) Do you feel that your knowledge of technology grew or increased by working in the PLC through the technology training sessions?

(7) Why or Why not? (Please explain)

*ETTR/R Question 1:*

Using responses from Question 1 on the ETTR/R, the participants ranked the training sessions in the following order as being the most beneficial: Computer Shortcuts, Digital Data-bases and Excel Tips equally ranked second, Managing Your e-Mails ranked fourth, and Search Engines ranked as the least beneficial training session.

*ETTR/R Question 2:*

The benefits of the sessions were measured by Question 2 on the ETTR/R. The question was open-ended and responses were sorted for themes. The following themes emerged: learning to manage digital data, learning with a group or PLC, and using the training for daily tasks.
Many participants expressed a satisfaction in learning to manage digital data. Several participants commented on how they enjoyed learning “new tricks” on managing their e-mails. One participant stated that “[I] have learned how to save all my parent e-mails in one folder. Now I can even create folders-within-folders in my e-mails. I had no idea you could even do that!” Four participants noted how they enjoyed learning how to add a personalized signature to their e-mails. Other participants felt they benefited the most by learning new skills in Excel. One participant noted that she could now “manage more data in less time with spreadsheets” because of what they learned in the Excel Tips training session. Another participant stated that they would now be able to manage their data more effectively because they had learned how to “change various columns and tab colors” in Excel.

Other participants believed that learning in a PLC was the most beneficial and rewarding part of participating in the technology training sessions. One participant stated that “helping each other” to “learn together” was the most beneficial. Another participant stated that she enjoyed the “affirmation from colleagues that I can do this work [learn technology].” An additional comment from a participant stated “I felt good, I felt useful, I was helping other people learn something but at the same time, I was learning.”

Several participants felt the most beneficial element of participating in the training sessions was learning how to use the information to assist with daily tasks at work. Most of these participants enjoyed the Digital Databases and
Computer Shortcut training session the most. One participant stated that the sessions assisted her by teaching “shortcuts in programs she was already fluent with” while another participant stated that the “new data bases would [will] help me each time I create or plan for a lesson.”

ETTR/R Question 3:

The response to Question 3 on the ETTR/R which asked whether participants felt they worked more independently in each session or in the PLC revealed that a little more than half of the participants believed they worked best in the PLC while marginally less than half of the participants believed they worked best independently in the training sessions.

ETTR/R Question 4:

Question 4 on the ETTR/R asked participants what they enjoyed most about working in a PLC. After sorting the data, the following themes emerged: working with colleagues, sharing ideas, and helping others.

The majority of participants most enjoyed the benefit of working with colleagues in a PLC in order to learn technology. The following are comments made by participants: “[I enjoyed] working with colleagues who took the time to explain [the session training] and even write directions for me.” “Working with professionals was rewarding.” “I really liked learning from my coworkers, it made it easier.”
Other participants most enjoyed sharing new ideas via the PLC. The researcher tallied seven individual responses that stated “sharing ideas” with one another in technology was the most enjoyable part of being in a PLC.

Many participants noted that although they felt as if they were already skilled in technology, they enjoyed helping their colleagues benefit from the sessions by assisting them with the new information. Participants made the following comments: “I liked being able to help others while learning from peers rather than strangers.” Many participants were extremely moved by their colleagues’ “willingness to help” those who were struggling. One participant stated “[I liked] practicing the new skills because other people were helping me.”

**ETTR/R Question 5:**

Participants were asked what they enjoyed least about working in a PLC via Question 5 on the ETTR/R. The responses were sorted by the researcher and two main themes emerged: pace of group vs. individual pace and time constraints.

Several participants stated that the sessions would have been more productive for them had they been grouped with other individuals with comparable technology skills. One participant stated “Everyone works at different paces on different tasks.” While another stated “[Some] people slow me down, but as long as I have the opportunity to help others, it’s OK (sic).”

Several participants stated that time was what they least liked about learning technology through the PLC training sessions. Although the training
sessions lasted about forty-five minutes each, all of the sessions were held outside the school-work day. All participants who attended were volunteering their unpaid time to participate in the study. Four participants stated that “staying after school” was what they least liked about the training sessions. Another participant did not mind staying after for the sessions but believed the sessions were too short and stated that the “time – goes too fast” in the training sessions. Another participant made a similar statement, “I needed more time on some of them [the sessions] to understand.”

ETTR/R Questions 6 & 7:

Questions 6 and 7 on the ETTR/R asked participants if they believed their knowledge of technology had grown because of working in a PLC and why they felt it had or had not. Every participant stated that their knowledge of technology had grown due to working in a PLC. The reasons for this growth were sorted by the researcher; however, no specific themes emerged.

Summary of the Findings

Question 1: Teachers’ Technological Skill and Use Level

One of the primary research questions that drove this study questioned the technology skill and use level of the studied population. The researcher sought to discover teachers’ skill and use level of technology using the TSPRT and the TSPST as tools of measurement. Mixed-model ANOVA tests were used to measure the data that were collected. The results showed that teachers only showed significant growth in seven of the 14 technological areas that were
measured. On Questions 4, 6, and 11 of the TSPRT/TSPST teachers, regardless of condition, scored higher on the post-test than on the pre-test. On Questions 5, 9, and 14 of the TSPRT/TSPST, the treatment group went up from the pre- to post-test while the non-treatment group actually went down in scores. A finding of special interest tied to Question 14 on the TSPRT versus the outcome of the scores on the TSPST could be due to the fact that during the same school year as the study took place, the school’s administration was requiring that teachers keep and update their own web pages on a weekly basis. The software that administration required teachers to use was new to all teachers and no formal training was offered to teach this software. However, teachers in the treatment group specifically asked their research-created PLCs for assistance in maintaining their web pages. It may be that those in the non-treatment group were struggling to learn the new software used to maintain the web pages and did not have a network of other professionals to assist them with this new technology while those teachers in the treatment group already had a professional network of teachers to assist them. Thus, this could explain why those in the treatment group had scores on Question 14, related to web page construction, that went up from pre- to post-test while those in the non-treatment group had scores that actually went down over the course of the study. Data for Question 12 showed that teachers in the treatment group had increased scores in technology use and knowledge, while the non-treatment group scores stayed the same.
Question 2: Barriers Inhibiting Teachers’ Use of Technology

Another research question that drove the study related to the barriers that prevent teachers from using technology in the classroom. A digital survey which was qualitative in nature was used to measure what teachers perceived as barriers in inhibiting their use of technology. Four primary themes emerged: time, training, self-efficacy, and funding. Based on participant responses, teachers are not only constrained on the time they have available for new training but they are also protective of their uncompensated time outside the regularly defined school day. Participant teachers also believed that training sessions were too infrequent and new technology training was rarely reinforced through practice. Other participant teachers believed that it was their own lack of self-efficacy that prevented them from obtaining the confidence to overcome their fears of using technology. Finally, other participant teachers believed that funding prevented their school district from purchasing new technologies or sending them to be trained on how to use new technologies.

Question 3: Professional Learning Community Encouraging Technology

The final question that drove the study of the researcher questioned to extent to which a PCL could encourage the use of technology by teachers. The summary findings were reported using two tools: the Presentation Feedback surveys and the End of Technology Training Reflection/Review (ETTR/R). The Presentation Feedback survey results did not report any significant differences between any of the sessions. The mean rating for these presentations on a
Likert-scale rating of 1-5 was 4.46. The data showed something similar to what is known as the Hawthorne effect, an effect that explains possible positive results in intervention studies (Wickström et al., 2000). In this study, it appeared that the participants were attempting to please the researcher by giving overly high rankings to each technology session via the Presentation Feedback surveys (see Appendix I). This may explain why there were no significant differences on any level between any of the training sessions.

Question 1 on the ETTR/R asked participants to rate which technology training session was most beneficial to them. The reported statistics suggest that participants were almost equally divided in their opinion as to which training session was most beneficial. The wide variety of options could have allowed such an even distribution of opinions. However, the Search Engines training session was ranked the lowest of all the training sessions.

Question 2 revealed that the most beneficial components to the technology training sessions were learning to manage digital data, working with a PLC, and using the information on a daily basis. Almost every participant noted that working with a PLC in the sessions greatly influenced their ease and understanding of the training sessions. However, Question 3 revealed that the participants believed they worked as well independently as they worked dependently with the PLC.

Questions 4 and 5 revealed that teacher participants most enjoyed helping others learn and share ideas in the sessions via the PLC. These questions also
revealed that teacher participants least enjoyed maintaining the pace of the PLC in contrast to their individual paces. Additionally, participants felt strained to learn so much information in such a limited amount of time.

Questions 6 and 7 on the ETTR/R asked participants if they believed their knowledge of technology had increased due to working in a PLC. Although every participant reported that they believed their knowledge had increased, no specific themes explaining why they believed their knowledge had grown emerged.

Despite the fact no particular themes emerged to explain “why” participants felt that their knowledge of technology had grown, another finding of special interest did emerge from the data. On each area of significant growth from the TSPRT to the TSPST, there was a technology training session offered via the research study that directly correlated with the areas of growth. Thus, it appeared that working to learn technology through a collaborating PLC did have a positive and statistically significant link to the growth of technological knowledge.

Conclusions

The conclusions of this study are related back to the research questions which drove the study as well as the professional literature which assisted with the creation of the research study. Question 1 of the research study sought to measure the skill and use level of the teacher population in the studied environment. The results of the mixed-model ANOVA showed statistically
significant growth on seven of fourteen technologically assessed areas. In three of these areas both the treatment and the non-treatment groups showed growth which indicates that the technology training may not have been responsible for the growth of the treatment groups. Thus, only four of the seven statistically significant areas of growth may be related to the training sessions because the treatment groups’ skill use and level increased while the non-treatment group levels decreased or stayed the same.

Research done by McKenzie (2001) found that the most effective learning strategy for teachers to learn technology was to change how teachers work together to achieve a common goal. McKenzie found that informal support systems, partnerships, teams and collaborative structures brought the most broad-based changes in how teachers learn and adapt to new technologies.

Question 2 of the research study attempted to identify the barriers which prohibit the use of technology in the classroom. The participating teachers were aware of their perceived barriers to using technology but were not sure as how to resolve these barriers. These barriers included: time, training, self-efficacy, and funding. The technology training sessions were only able to address the barriers of training and self-efficacy.

According to Mumtaz (2000) there are several factors that explain the disparity between the uses of technology in the classroom compared to the availability of technology in the classroom. These included a lack of experience teaching with technology, a lack of on-site support that encouraged the use of
technology, a lack of help supervising students when using computers, a lack of technology instructors in the school building, a lack of computer availability in the school, a lack of financial support to fund technology, and a lack of time required for teachers to learn new forms of technology. Starr (2000) conducted interviews with the thirty-five members of Education World’s Tech Team to uncover similar data. This team interviewed teachers from across the United States and questioned their perceived barriers to using technology in the classroom. Starr’s (2000) research showed data very similar to the data that were produced via this research study. The data showed that the teachers in the studied environment experienced similar barriers to technology that teachers across the nation experience. Thus, the data showed that the studied teachers’ experiences were not unique to this study.

Question 3 of the research study sought to measure the extent to which a PLC would encourage the use of technology. The researcher found qualitative data that suggested the positive benefits of learning technology in a PLC. All participants believed that their knowledge of technology had grown but could not specifically state why or how the PLC had encouraged this growth.

According to McKenzie (2001), linking technology-based instruction to an informal support system or partnership within the school is necessary to make learning meaningful for teachers. Matsuo (2005) stated that programs to teach technology to teachers “should be taught by other teachers” (p. 15). Additionally, Hord (1997) noted, "As an organizational arrangement, the professional learning
community is seen as a powerful staff-development approach and a potent strategy for school change and improvement" (p. 12).

While the vast majority of participants expressed that they had benefitted, enjoyed, and learned technology through the PLC model, almost half of the teacher participants reported that they had worked independently of it. Thus, the researcher concluded that while half of the participants felt they could learn effectively without working in a PLC, the other half believed working in a PLC greatly influenced how effectively they had learned in the training sessions.

Recommendations

Based on the findings of this investigation, the researcher suggests the following recommendations for further understanding of this research:

1. Replication: Though the research produced significance, the research study would need to be replicated in order to verify the findings.

2. Study of a more Diverse Population: There was a skill and use level disparity between the treatment and non-treatment groups. Thus, the data may be more detailed should further research be conducted with a population whose technological knowledge is more diverse than the studied population.

3. Additional Instrumentation: The researcher recommends additional instrumentation be used to measure teachers’ skills, use levels, and perceptions that may be more revealing and beneficial to this type of research. Though the TSPRT and TSPST created by Johnson (1995 &
2007) gave the researcher a great amount of data, participants may have recognized the post-test as the pre-test and the Hawthorne effect may have been present.

4. Study an Unknown Population: The researcher recommends that this study be done in an environment where the researcher does not have a personal connection to the participants in the study.

5. Provide History: Should this research design be replicated, it may be beneficial to provide participants with a history and working definitions of a PLC in order to familiarize the participants with the desired qualities of a PLC.

Implications

The researcher experienced various revelations throughout the duration of the research study. One of these revelations was that participant teachers who share a close or personal working relationship with the researcher will often provide positive feedback in the form of research data in the hopes that it may assist the researcher with her findings. Thus, the researcher would suggest that this research be done with a population who has no personal ties to the researcher. Additionally, the researcher discovered that participants did not like the idea of working with other participants whose level of technology was significantly lower than their own. Thus, the researcher suggests that if this study were to be done again, it may be beneficial to explain the goals, history, and model of a PLC in order to encourage intended functions of a PLC. The
researcher also noted that participants readily recognized the TSPST as the TSPRT but only with a different title. Thus, the researcher would suggest the addition of another form of instrumentation to measure technology skills in the hopes that the treatment-group would not deliberately attempt to provide positive growth data from pre- to post-test. Finally, the researcher did discover statistically significant data that tied each area of growth in the treatment group directly to an individual technology training session that was held. Areas of growth that were measured using the TSPRT and the TSPST included: word processing skills, spreadsheet knowledge, databases, network and Internet use, the ethical understanding of technology, E-mail and electronic mailing, and web page construction. The researcher was able to pair each of these areas of skill and use growth with specific technology training workshops that were provided during the duration of the research process.

One of the global ideas that emerged from this research study was that although participants may not be able to state specifically how a PLC assists them with learning, they are aware that working collaboratively with a PLC does produce feelings of positive gains. Participants in this study were aware of a relationship between learning technology in association with working in a PLC.

This research study further backs up previous studies by leading researchers such as Hord (2004) and DuFour, Eaker, & DuFour (2005) who have found that teachers and other professionals will show increased knowledge and confidence by working in a PLC. This study also found that the teachers in the
studied environment did not perceive their barriers to technology as being unique to the studied environment. Rather, this research study found that the teachers in this study experienced very similar barriers to technology as teachers from across the United States. Additionally, this study reinforces the research done by McKenzie (2001) who found that teachers showed the most growth in technological knowledge by working in a group similar to a PLC in order to collaboratively learn new technology skills.

Deliverables

Throughout the length of this research study, the researcher produced the following deliverables: a professional development presentation, a digital blog, and a compact disc with all of the digital resources used for the training sessions. The researcher gave a digital presentation in the form of a PowerPoint to the faculty and staff of a middle school in rural West Tennessee explaining the history and use of Pod-casting in the classroom.

A second deliverable produced was a digital blog. This blog was hosted by www.teacherlingo.com in order to address the dissertation, the dissertation process, the research design, the measurement of the data, and the implications of the data. Other teachers were able to ask questions from the researcher and post suggestions and comments on the internet blog relating to the research process and outcome.

The final deliverable produced by the researcher was a compact disc containing all materials that were used during the training sessions. These digital
resources contain on-line links to technology resources, PowerPoints with guides, as well as Word documents containing directions on how to use digital data bases as well as search engine tools.
REFERENCES


http://www.ed.gov/about/offices/list/os/technology/facts.html


Weiss, J. (1994). Keeping up with the research: Tips on how to use technology to provide a positive impact on kids. *Technology & Learning, 14,* 30-33.


Appendix A

Technology Skills Pre-Test/Post-Test
Technology Skills Pre-Test
This is not a test of your skills, but a measure to help us in planning technology instruction. Some assignments will be made after the interviews to help with any special needs.

Beginning Technology Rubric
Please judge your level of achievement in each of the following competencies. Circle the number which best reflects your current level of skill attainment. (Be honest, but be kind.) At the end of the training program, you will complete the same set of rubrics that will reflect your level of skill attainment at that time. (Level 3 is considered mastery.) This tool is to help measure the effectiveness of our training program and to help you do a self-analysis to determine the areas in which you should continue to learn and practice.

I. Basic computer operation (NETS I.A., I.B.)
Level 1  I do not use a computer.
Level 2  I know the basic operations of using a mouse, clicking, and working with windows. I can use the computer to open, run and close a few specific, preloaded programs. Computer use has little effect on how I work. I am somewhat anxious I might damage the machine or its programs.
Level 3  I can set-up my computer and peripheral devices, load software, print, and use most of the operating system tools like the clipboard, clock, note pad, find command, and trash can (recycling bin). I can format a data disk, connect to my school’s network, and run programs that require a CD. I have a virus protection program that scans my files on a regular basis.
Level 4  I can run several programs simultaneously, and have multiple windows open at the same time. I can customize the look and sounds of my computer. I use techniques like shift-clicking to work with multiple files. I look for programs and techniques such as using virtual memory to maximize my computer system. I feel confident enough to teach others some basic operations.

II. File management (NETS I.A., I.B.)
Level 1  I do not save any documents I create using the computer.
Level 2  I save documents I’ve created but often have difficulty finding them. I do not store duplicates of my files on disks or servers for back-up purposes.
Level 3  I have a filing system for organizing my files, and can locate files quickly and reliably in folders and subfolders. I back-up my files to disk, file server, or Internet storage site on a regular basis. I use the district’s networked file storage server when provided so I can access my files from any computer, including my home computer.
Level 4  I regularly run a disk-optimizer on my hard drive, and use a back-up program to make copies of my files on a weekly basis. I have a system for archiving files which I do not need on a regular basis to conserve my computer’s...
hard drive space.

**III Time management and organization (NETS V.C.)**

Level 1  I do not use electronic tools or devices to help me keep a calendar or organize my tasks and address book.

Level 2  I can access the school’s calendar for basic schedule information.

Level 3  I use an electronic calendar program, to-do list, and address book that includes email address to help organize and schedule my professional activities. I can synchronize the information on my computer with that in my PDA.

Level 4  I store my calendar, task manager, and address book online so it can be accessed from any networked computer.

**IV. Word processing (NETS I.A., I.B. V.C.)**

Level 1  I do not use a word processor, nor can I identify any uses or features it might have which would benefit the way I work.

Level 2  I occasionally use the word processor for simple documents that I know I will modify and use again. I generally find it easier to handwrite or type most written work I do.

Level 3  I use the word processor for nearly all my written professional work: memos, tests, worksheets, and home communication. I can edit my document using commands like copy and paste, find, undo, and “save as.” I can spell check, and change the format of a document. I can paginate, preview and print my work. I can use tables within my documents. I feel my work looks professional.

Level 4  I can save my document as a text or rtf document so it can be opened by others who may use the same word processor I use. I take advantage of collaborative writing/editing environments when available. I use the word processor not only for my work, but have used it with students to help them improve their own communication skills.

**V. Spreadsheet use (NETS I.A., I.B., V.C.)**

Level 1  I do not use a spreadsheet, nor can I identify any uses or features it might have which would benefit the way I work.

Level 2  I understand the use of a spreadsheet and can navigate within one. I can create a simple spreadsheet that adds a column of numbers.

Level 3  I use a spreadsheet for several professional applications such as keeping a budget or analyzing student data. My spreadsheets use labels, formulas and cell references. I can change the format of the spreadsheets by changing column widths and text style. I can use the spreadsheet to make a simple graph or chart.

Level 4  I can import a spreadsheet into a word processing document or presentation program when needed. I use the spreadsheet not only for my work, but have used it with students to help them improve their own data keeping and analysis skills.

**VI. Database use (NETS I.A., I.B., V.C.)**

Level 1  I do not use a database, nor can I identify any uses or features it might have which would benefit the way I work.
Level 2 I understand the function of a database and can locate information within one that has been pre-made. I can add or delete data in a database.

Level 3 I use databases for professional applications. I can create a simple original database that has a professional application such as an address book by defining fields and creating layouts. I can find, sort and print information that is useful to me. I can use my building’s student information system database to find information about students in my class.

Level 4 I can use formulas with my database to create summaries of numerical data. I can use database information to do mail merge in a word processing document. I use the database not only for my work, but have used it with students.

VII. Graphics and digital image use (NETS I.A., I.B. V.C., V.D.)

Level 1 I do not use graphics in my word processing or presentations, nor can I identify any uses or features they might have which would benefit the way I work.

Level 2 I can open and create simple pictures with the painting and drawing programs. I can use programs like PrintShop or CardShop.

Level 3 I use both pre-made clip art and simple original graphics in my word-processed documents and presentations. I can edit clip art, change its size, and place it on a page. I can use most of the drawing tools, and can group and un-group objects. I can use the clipboard to take graphics from one application for use in another. I can take, import, edit, and use images from a digital camera in my work. I can use a scanner. The use of graphics in my work helps clarify or amplify my message.

Level 4 I use graphics not only for my work, but have used them with students to help them improve their own communications. I can use graphics and digital images to create a professional looking newsletter. I can do basic editing of digital video production.

VIII. Hypermedia/presentation software (PowerPoint) use (NETS I.A., I.B.)

Level 1 I do not use hypermedia or presentation software, nor can I identify any uses or features it might have which would benefit the way I work.

Level 2 I can navigate through a pre-made hypermedia program or presentation program. I can create a simple presentation using a program’s templates or wizards.

Level 3 I can create my own hypermedia stacks and computer presentations that can be used to accompany a lesson in my classroom. These stacks use navigation buttons, sounds, dissolves, graphics, and text fields. I know some basic rules of graphic design that can apply when designing the presentation. I can use an LCD projection device to display the presentation to a class. The computer generated slides help reinforce or amplify my message.

Level 4 I can link to other programs and to websites from my hypermedia
stacks or presentations. I use hypermedia and presentation programs with students in their own information keeping and communication efforts.

**IX. Network and Internet use (NETS I.A., I.B. V.A., V.D.)**

- **Level 1** I do not use the on-line resources available in my building, nor can I identify any uses or features they might have which would benefit the way I work.
- **Level 2** I understand that there is a large amount of information available to me as a teacher that can be accessed through networks, including the Internet. With the help of the media specialist, I can use the resources on the network in our building.
- **Level 3** I use the networks to access professional and personal information from a variety of sources including networked CD-ROM reference materials, on-line library catalogs and periodical databases, and the World Wide Web. I have an e-mail account that I use on a regular basis to communicate with parents and other professionals. I use the district-specific networked resources that are available to me such as file storage space, student information, IEP forms, curriculum guides, and online forms. I have a strategy for analyzing the quality of information I find online.
- **Level 4** Using telecommunications, I am an active participant in on-line discussions, can download files and programs from remote computers. I use the network to share documents with my colleagues for collaborative review and editing. I accept student work sent to me electronically. I use telecommunications activities with my students.

**X. Student Assessment (NETS IV. A.)**

- **Level 1** I do not use the computer for student assessment.
- **Level 2** I understand that there are ways I can keep track of student progress using the computer. I keep some student produced materials on the computer, and write evaluations of student work and notes to parents with the word processor.
- **Level 3** I effectively use an electronic grade book to keep track of student data and/or I keep portfolios of student produced materials on the computer. I use the electronic data during parent/teacher conferences. I use the networked grading, attendance, report card/progress report, and discipline system provided by my district.
- **Level 4** I rely on the computer to keep track of outcomes and objectives individual students have mastered. I use that information in determining assignments, teaching strategies, and groupings.

**XI. Ethical use understanding (NETS VI. A, D, F.)**

- **Level 1** I am not aware of any ethical issues surrounding computer use.
- **Level 2** I know that some copyright restrictions apply to computer software.
- **Level 3** I clearly understand the difference between freeware, shareware, and commercial software and the fees involved in the use of each. I know the programs for which the district or my building holds a site license. I understand
the school board policy on the use of copyrighted materials. I demonstrate ethical usage of all software and let my students know my personal stand on legal, moral, and safety issues involving technology. I know and enforce the school’s technology policies and guidelines, including its Internet Acceptable Use Policy. I have a personal philosophy I can articulate regarding the use of technology in education.

Level 4  I am aware of other controversial aspects of technology use including data privacy, equitable access, and free speech issues. I can speak to a variety of technology issues at my professional association meetings, to parent groups, and to the general community.

XII. Email and electronic mailing lists
Level 1  I do not use email.
Level 2  I understand the concept of email and can explain some administrative and educational uses for it.
Level 3  I use email regularly and can:
  - read and delete messages
  - send, forward and reply to messages to
  - create nicknames, mailing lists, and a signature file
  - send and receive attachments
  - use electronic mailing lists and understand the professional uses of them
  - read and contribute to a professional electronic mailing list
Level 4  I can send group mailings and feel confident that I could administer an electronic mailing list. I use activities that require email in my teaching. I can locate lists of subject oriented mailing lists.

XIII. Search tools and evaluation strategies
Level 1  I cannot locate any information on the Internet.
Level 2  I can occasionally locate useful information on the Internet by browsing or through remembered sources.
Level 3  I can conduct an efficient search of Internet resources using directories like Yahoo or search engines like Google, Lycos, or Infoseek. I can use advanced search commands to specify and limited the number of hits I get. I can state some guidelines for evaluating the relevance of sited and the quality of the information I find on the Internet. I can write a bibliographic citation for information found.
Level 4  I can identify some specialized search tools for finding software and email addresses. I can speculate on future developments in on-line information searching including know-bots and other kinds of intelligent search agents.

XIV. Webpage construction
Level 1  I cannot create a page which can be viewed with a web browser.
Level 2  I can save text I’ve created as an html file with a command in my word processor. I know a few, simple html commands.
Level 3  Using hand-coded html or a web page authoring tool, I can:
  - view web pages as a source documents
- create a formatted web page that uses background color, font styles and alignment, graphics, and tables
- include links to other parts of my document or other Internet sites in my page
- know basic guidelines for good web page construction and the district’s web policies

Level 4 I can use the web as an interface to databases. When appropriate, I can register my pages with search engine sites. I can help write web creation policies for design, content, and use.
Appendix B

Consent to Participate
Consent to Participate in Doctoral Action-Based Research:

Technology Training in Professional Learning Communities

I, ________________________, am willing and knowingly participating in a doctoral research study. I understand that I will receive free technology training in a Professional Learning Community after school hours on the school campus. I understand that participating is voluntary and that I may withdraw from this program at any time without penalty.

I also give Callie Watts permission to informally observe the training sessions, take notes, and will allow her to use any information gained from interviews or observations with me in her dissertation research study.

I also give Callie Watts permission to view and use my data in her doctoral research. I understand that the data gathered for this study will protect the confidentiality of both me and the school. I understand that this data will be submitted to Trevecca Nazarene University and used in the publication of Callie Watts’ dissertation research.

I understand that information gained from this research process may be published. I also understand that this same information will be held on record at Trevecca Nazarene University and may be published in future scholarly publications without further consent.

Risks involved with this study may include:
- Anxiety about learning new information
- Increased frustration with new forms of technology
- Disappointment due to inability to learn new forms of technology at the desired or anticipated pace as set by the technology training sessions
- Discord between members of the Professional Learning Community

Signed: ________________________________ Dated:__________
Appendix C

TNU Institutional Review Board Letter of Approval
Institutional Review Board

Nov. 5, 2007

Callie Watts Haraway
742 Vernon Ave.
Nashville, TN 37209

Dear Callie Watts Haraway,

Thank you for submitting your proposed research project, *Teaching Teachers Technology through Professional Learning Communities*, to the Trevecca Nazarene University Institutional Review Board. Your project has been reviewed and approved. Please make sure you follow the research procedures you described in your application when you conduct your research. This study is subject to continuing review on or before 11.05.08, unless closed before that date. Please submit the appropriate application prior to that date. Changes classified as modifications to your research project must be promptly reported and approved by the IRB.

Thank you for your cooperation with the IRB human subjects review process.

Best wishes for a successful study.

Ruth T. Kimnersley, IRB Chair
Trevecca Nazarene University

CC: IRB records
    Doctoral advisor
Appendix D

Approval Letter from Local School Administration
7/23/07

To:
Trevonna Nazarene's Institutional Review Board
Belinda Moss, Technology Director Williamson County Schools

I hereby grant Callie Watts (Haraway) permission to conduct her dissertation research with the faculty of Fairview Middle School. I am aware that she will be using human participants in order to study the impact of cooperative team learning on the use and knowledge of technology in order to increase classroom learning. I am aware that she will conduct this research on the premises before and after school hours and will utilize various forms of technology owned by and licensed to FMS and Williamson County.

Callie will continually keep me informed and updated on the process and progression of her study throughout the school year.

Sincerely,

[Signature]
Brian Bass
Principal
Fairview Middle School
Appendix E

Table 1
Table 1

Descriptive Statistics for Technology Skills Pre-Test and Post-Test

<table>
<thead>
<tr>
<th>Question</th>
<th>Treatment</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Non-Treatment</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
<td>Pre</td>
<td>Post</td>
<td></td>
<td>Pre</td>
<td>Post</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>1</td>
<td>2.92</td>
<td>0.82</td>
<td>3.34</td>
<td>0.78</td>
<td>6.58</td>
<td>11.83</td>
<td>3.25</td>
<td>1.06</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2.47</td>
<td>0.77</td>
<td>2.87</td>
<td>0.47</td>
<td>2.92</td>
<td>0.52</td>
<td>2.92</td>
<td>0.67</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1.95</td>
<td>0.85</td>
<td>2.47</td>
<td>0.91</td>
<td>2.75</td>
<td>0.96</td>
<td>2.75</td>
<td>1.14</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2.82</td>
<td>0.77</td>
<td>3.05</td>
<td>0.97</td>
<td>3.08</td>
<td>1.08</td>
<td>3.33</td>
<td>0.89</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2.11</td>
<td>0.10</td>
<td>2.84</td>
<td>0.90</td>
<td>2.92</td>
<td>0.10</td>
<td>2.83</td>
<td>1.03</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1.84</td>
<td>0.96</td>
<td>2.42</td>
<td>0.77</td>
<td>2.42</td>
<td>0.51</td>
<td>2.70</td>
<td>0.99</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>2.53</td>
<td>0.91</td>
<td>3.03</td>
<td>0.98</td>
<td>3.00</td>
<td>1.04</td>
<td>3.00</td>
<td>0.95</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>2.05</td>
<td>0.80</td>
<td>2.63</td>
<td>1.01</td>
<td>2.75</td>
<td>1.14</td>
<td>2.75</td>
<td>1.21</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>2.74</td>
<td>0.56</td>
<td>3.16</td>
<td>0.69</td>
<td>3.17</td>
<td>0.83</td>
<td>3.08</td>
<td>0.80</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>2.53</td>
<td>0.64</td>
<td>2.93</td>
<td>0.88</td>
<td>3.18</td>
<td>0.94</td>
<td>3.00</td>
<td>1.12</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>2.47</td>
<td>0.70</td>
<td>3.00</td>
<td>0.74</td>
<td>2.83</td>
<td>0.93</td>
<td>2.92</td>
<td>0.99</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>2.84</td>
<td>0.51</td>
<td>3.53</td>
<td>0.51</td>
<td>3.20</td>
<td>1.03</td>
<td>3.25</td>
<td>0.97</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>2.70</td>
<td>0.48</td>
<td>3.11</td>
<td>0.66</td>
<td>3.25</td>
<td>0.62</td>
<td>3.20</td>
<td>0.83</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>1.80</td>
<td>0.98</td>
<td>2.50</td>
<td>0.96</td>
<td>2.60</td>
<td>1.10</td>
<td>2.50</td>
<td>1.17</td>
<td></td>
</tr>
</tbody>
</table>
Appendix F

Table 2
### Table 2

*F-Values for Mixed-Model ANOVAs*

<table>
<thead>
<tr>
<th>Question</th>
<th>WS&lt;sup&gt;a&lt;/sup&gt;</th>
<th>BS&lt;sup&gt;a&lt;/sup&gt;</th>
<th>I&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.23</td>
<td>1.63</td>
<td>2.04</td>
</tr>
<tr>
<td>2</td>
<td>3.23</td>
<td>1.48</td>
<td>3.23</td>
</tr>
<tr>
<td>3</td>
<td>2.60</td>
<td>3.04</td>
<td>2.60</td>
</tr>
<tr>
<td>4</td>
<td>4.42*</td>
<td>0.73</td>
<td>0.00</td>
</tr>
<tr>
<td>5</td>
<td>4.90*</td>
<td>1.51</td>
<td>7.71*</td>
</tr>
<tr>
<td>6</td>
<td>6.41*</td>
<td>2.45</td>
<td>1.01</td>
</tr>
<tr>
<td>7</td>
<td>3.23</td>
<td>0.47</td>
<td>3.23</td>
</tr>
<tr>
<td>8</td>
<td>3.84</td>
<td>1.40</td>
<td>3.84</td>
</tr>
<tr>
<td>9</td>
<td>2.55</td>
<td>0.56</td>
<td>5.68*</td>
</tr>
<tr>
<td>10</td>
<td>0.59</td>
<td>1.25</td>
<td>3.51</td>
</tr>
<tr>
<td>11</td>
<td>5.06*</td>
<td>0.26</td>
<td>2.67</td>
</tr>
<tr>
<td>12</td>
<td>11.40*</td>
<td>0.01</td>
<td>6.99*</td>
</tr>
<tr>
<td>13</td>
<td>1.39</td>
<td>2.79</td>
<td>3.09</td>
</tr>
<tr>
<td>14</td>
<td>5.13*</td>
<td>1.32</td>
<td>8.37*</td>
</tr>
</tbody>
</table>

<sup>a</sup> df=1, 29  
*<sup>p</sup> < .05.  
WS = Within-subjects comparison.  
BS = Between-subjects comparison.  
I = Interaction.
Appendix G

Table 3
Table 3

Feedback Survey Responses

<table>
<thead>
<tr>
<th>Question</th>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
<th>Session 5</th>
<th>p^a</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>1</td>
<td>4.86</td>
<td>0.36</td>
<td>4.50</td>
<td>0.86</td>
<td>4.64</td>
<td>0.75</td>
</tr>
<tr>
<td>2</td>
<td>4.93</td>
<td>0.27</td>
<td>4.50</td>
<td>0.76</td>
<td>4.71</td>
<td>0.82</td>
</tr>
<tr>
<td>3</td>
<td>5.00</td>
<td>0.00</td>
<td>4.64</td>
<td>0.063</td>
<td>4.64</td>
<td>0.84</td>
</tr>
<tr>
<td>4</td>
<td>4.86</td>
<td>0.36</td>
<td>4.79</td>
<td>0.43</td>
<td>4.86</td>
<td>0.36</td>
</tr>
<tr>
<td>5</td>
<td>4.86</td>
<td>0.36</td>
<td>4.71</td>
<td>0.61</td>
<td>4.57</td>
<td>0.93</td>
</tr>
<tr>
<td>6</td>
<td>4.71</td>
<td>0.47</td>
<td>4.57</td>
<td>0.85</td>
<td>4.71</td>
<td>0.47</td>
</tr>
<tr>
<td>7</td>
<td>4.86</td>
<td>0.36</td>
<td>4.71</td>
<td>0.61</td>
<td>4.79</td>
<td>0.43</td>
</tr>
</tbody>
</table>

^a df = 4, 52.
Appendix H

End of Technology Training Reflection/Review
End of Technology Training Reflection/Review
*Please DO NOT put your name on this survey.

1. Which session was most beneficial to you?
   ___ Managing Your E-Mails
   ___ Computer Shortcuts
   ___ Search Engines
   ___ Digital Databases
   ___ Excel Tips

2. What specifically benefited you the most from the training sessions?
   (please explain with detail)

3. Did you work more in these sessions:
   ___ Independently
   ___ With others in the PLC (either assisting or receiving assistance)

4. What did you like most about working in the Professional Learning Community? (please provide details)

5. What did you like least about working in the Professional Learning Community? (please provide details)

6. Do you feel that your knowledge of technology grew or increased due to training and working with the PLC?  YES  NO

7. Please explain your response to Question 6:
Appendix I

Presentation Feedback Survey
Presentation Feedback Survey

*Please DO NOT put your name on this survey.*

1. The presentation related to best practices. (Either to the school itself or the school system itself.)
   LOW 1 2 3 4 5 HIGH

2. The presentation provided opportunity to develop new knowledge.
   LOW 1 2 3 4 5 HIGH

3. The presentation provided opportunity to develop new skills.
   LOW 1 2 3 4 5 HIGH

4. The presentation demonstrated effective use of technology.
   LOW 1 2 3 4 5 HIGH

5. The presentation will assist me with work I do here at school.
   LOW 1 2 3 4 5 HIGH

6. I will be able to apply & use the information I learned in the presentation on my own. (I can use this information and now practice the new skills without assistance.)
   LOW 1 2 3 4 5 HIGH

7. The way in which the information was presented was easy to understand.
   LOW 1 2 3 4 5 HIGH

**Please feel free to add additional comments or suggestions:**

Thank you for your continued support and participation.

-Callie E. Watts
Appendix J

Digital Survey
1. In your opinion, what are some of the barriers you face in using technology? (The more detail you provide, the better.)

2. How often do you use technology to enhance your lessons or work at school?
   - How often do you use technology to enhance your lessons or work at school? daily
   - at least three times a week
   - about once a week
   - less than four times in a month

3. Rate your anxiety level in using technology to enhance your lessons or assist you with work: 1 being LOW and 5 being high
   - 1
   - 2
   - 3
   - 4
   - 5
   Done