Teachers as Technology Leaders: A Case Study of a One-to-One Laptop Initiative

by

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A dissertation submitted to the Graduate Faculty of
Auburn University
in partial fulfillment of the
requirements for the Degree of
Doctor of Philosophy

Auburn, Alabama
August 4, 2012

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Abstract

Starting in 2005, Laptop Junior High School implemented a laptop program as a means of preparing students with 21st century skills. Leadership is the starting point for creating a school culture that embraces technologically enhanced instruction across the curriculum (Anderson & Dexter, 2005; Dexter, 2011). Some administrators are not prepared to fully lead the integration and use of technology in schools (Flanagan & Jacobsen, 2003). The need for technologically savvy leadership is presenting an opportunity for some teachers to go beyond their classroom walls, to help lead the use of digital tools throughout the school (Dexter, 2011, Riel & Becker, 2008).

The purpose of my research was to explore what teacher technology leadership looks like at Laptop Junior High School and to identify how the practices of teacher technology leaders differ from school administrators. My participants were teacher technology leaders and administrators. I conducted interviews with 7 teacher technology leaders, 1 novice teacher who has received support from the teacher technology leaders, the assistant principal and district technology coordinator. Interview data were analyzed using open and a priori coding. My analysis uncovered that action research was used as a tool to assist with the implementation of the laptop initiative. Action research was employed to create a shared vision among the faculty. It was also used to guide planning, identifying needed resources and professional development. Lastly action research was used to sustain the forward momentum of the organization. Teacher

technology and administrative leaders used action research to determine future technologies to be employed in the classroom.

My analysis also uncovered that teacher technology leaders at Laptop Junior High School provided technology assistance and guidance through formal activities such as weekly professional development. These teacher technology leaders also lent their expertise with technology to their peers through timely support and collaboration. The support occurred through impromptu meetings with peers in classrooms, hallways, and through email. Their formal and informal assistance have helped to alter the schools culture and teacher technology practices.

Acknowledgments

It is without any hesitation that I profess that my life has been profoundly touched by my professors at Auburn University. I would like to thank particularly my committee members who have labored mightily to help craft this document into something worthy of paper and ink. Dr. Lisa Kensler has served as a source of encouragement and a model of academic prowess. Her zeal for democratic schools and systems thinking has helped to shape the way I look at the world. Dr. Carey Andrzejewski was the inspiration for my pursuit of qualitative research. Her passion for investigating the spoken lives of others has helped to stoke my desire to become a researcher. Lastly Dr. Ellen H. Reames has proven to be a warm-hearted taskmaster who has instilled me with confidence and timely support throughout this lengthy process. She has given me the opportunity to add my voice to the research literature and has spurred my future aspirations towards higher education.

I am most appreciative of Christie H. Broom and Latryce Cole for serving as my peer reviewers. Their passion for learning and helping others is evident in all that they do. I would like to thank Mr. Billy Killingsworth, the best boss a person could ever ask for. Billy's belief in me all those many years ago, started me on the road to Auburn. I would also thank my parents who instilled in me a love of life and learning. All that you see good in me they are responsible. Lastly I would like to thank the love of my life Susan and our daughter Kelly. When the waters of life have turned choppy they have kept me afloat and steered in the right direction.

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List of Abbreviations

ICT   Information and Communication Technology

ISTE   International Society for Technology in Education

NETS -A   National Educational Technology Standards for Administrators

NETS-T   National Educational Technology Standards for Teachers

CHAPTER 1: NATURE OF THE STUDY

The end of the 1800s marked the beginning of an industrialized arms race that would influence the next 100 years of history. In 1890, Alfred Thayer Mahan argued that the strength of a nation could be measured by sea power (Mahan, 1890). A naval arms race ensued during the height of the Industrial Age that set the stage for the events of the 20th century (Ferreiro, 2008; Holmes, 2011). The flow of information and the ability to explore and discover was directly connected to the industrialized abilities of nations. The zenith of the Industrial Age was reached with our ability to ply the seas of space (Brown, 2011; DeGroot, 2007).

One hundred years after Mahan's theory, another revolution was launched. It would not be the sail, steam, or steel that would herald the new age; it would be the miniaturization of silicon chips. The decade of the 1990s witnessed the birth of the personal computer (Rutkowski, Rutkowski & Sparks, 2011). Targeted at the mainstream public, the early years of the computer revolution saw a rivalry and escalation of processing ability driven by a rapidly expanding and changing software market. This dam burst of digitized change is still ongoing as a multitude of new devices and applications become available annually (Myerson, 1992; Prensky, 2009; Ziegler, 1995).

A large part of that change arrived with the Internet (Campbell, 2006). Suddenly a new ocean for exploration, commerce, and communication was at people's fingertips (Pulley, McCarthy & Taylor, 2000). The Digital Age was born. Public schools were far from being prepared to navigate these technological waters (Riel & Becker, 2008). Many administrators

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believed that their role was simply to locate and provide the resources. Schrum et al. (2011) cited Dawson and Rakes (2003) that "many principals were uninformed and uninvolved in the technology role of their schools." They failed to effectively plan for training, support, and the integration of technology into the course of study (Anderson & Dexter, 2005; Clifford, Friesen & Lock, 2005; Cuban, Kirkpatrick & Peck, 2001). A gap arose because some principals were unprepared to lead the inclusion of technological skills in classrooms. The shortcoming had to be bridged by others familiar in current trends in technology (Dexter, 2011; Flanagan & Jacobsen, 2003; McLeod & Richardson, 2011; Yuen, Lee & Law, 2009).

I became indoctrinated by this revolution, while completing the requirements for a Master's degree in Educational Media at Auburn University in 1990. The personal computer was finding its way into colleges and classrooms, and I felt a fascination for these electronic tools that had developed over the last twenty years. I began my career in a rural school system that had been affected by a hurricane-based flood. The school system was compensated with funding that the superintendent used to purchase and implement a system of networked computers throughout all classrooms. Because of my recent computer experience at Auburn, the superintendent empowered me to assist in leading the integration of technology into the school. After 20 years of technology leadership, and a move to a larger city school system, I am still striving to support the use of technology in classrooms. The underlying reason behind this research is my passion in seeking to improve my own abilities through the research of others who are successful in shaping school culture to embrace technology.

Today, 21st century classrooms have access to a dizzying array of interactive hardware and software opportunities that leave many experienced educators and administrators scrambling to catch up (Cisco, 2008; Liu, 2010; Prensky, 2009, 2010; Sherry & Gibson, 2002). Yet some

teachers are embracing the interactive culture that has become intertwined in our society. These teachers are striving to change the culture of the school so that all classrooms become student-centered havens for searching digital resources, collaborating to find timely solutions, and communicating results (Dexter, 2011; ISTE, 2008; Luthra & Fochtman, 2011; Prensky, 2010, Silva, 2009). These teacher technology leaders are working with administrators to lead the integration and support of technology in schools (Dexter, 2011; Flanagan & Jacobsen, 2003; Katyal, 2010; Moyle & Webb, 2005; Riel & Becker, 2008; Sherry & Gibson, 2002). Teacher technology leadership may serve as means for changing school culture to embrace technology across the curriculum (Dexter, 2011; Donnison, 2007; Katyal, 2010; Luthra & Fochtman, 2011; Riel & Becker, 2008).

Purpose of the Study

Technology has become intertwined in all aspects of our society (Cisco, 2008; McLeod, 2011; Prensky, 2010; Silva, 2009). Students need research and technological skills in order to be competitive in a digital world (Bell, 2010; Cisco, 2008; Intel, 2008; Jukes, McCain & Crockett, 2010; Liu, 2010; Pappas, 2009). The superintendent of the Laptop School System (a pseudonym) argued "We've got to teach children to think critically and embrace the concepts they need to work in a technology-based world, whether or not they're going to be a professional" (Intel, 2008, p. 5). These technology-based critical thinking skills (http://www.21stCenturySkills.org) include:

21st Century Skills

• Creativity and Innovation • Critical Thinking and Problem Solving • Communication and Collaboration • Information Literacy • Media Literacy • Information, Communication and Technology (ICT) Literacy

Figure 1. 21st Century Skills (http://www.21stCenturySkills.org)

Schools are responsible for infusing these 21st century skills into the learning process (Jukes, McCain & Crockett, 2010; Liu, 2010; McLeod, 2011; Pappas, 2009; Prensky, 2009, 2010). Many schools have initiated a one-to-one laptop initiative as a way of transforming instruction and preparing students for life in the 21st century. In 2005 Laptop Junior High School implemented a one-to-one laptop initiative as a platform for incorporating 21st century skills into instruction. Experts at the state and district level identified Laptop Junior High School as a model school for teacher technology leadership. I performed a case study of Laptop Junior High School in order to examine the practices of teacher technology leaders as they help lead and support the one-to-one laptop initiative.

I grounded my case study in interview, observational and school website data. I also wanted to be sure that when I had completed my final analysis of the data, I would be able to differentiate administrative technology leadership practices from teacher technology leadership practices. Yin (2003) argued that a framework often guides case study research. Frameworks serve as a lens through which to understand and interpret meaning from the data. I chose two frameworks to serve as a lens for administrative technology leadership. Diane L. Yee (2000) performed a qualitative study of principals in the United States, New Zealand, and Canada who led the integration of information and communication technology (ICT) in their schools. The

participants were selected from schools where technology was regularly used to deliver instruction and the schools were active partners with local colleges. Yee's interviews provided thick descriptions of the daily rituals and experiences of principals who were successful in leading the integration of technology.

I also used the five standards (http://iste.org/standards/) for administrators (NETS-A, 2009) proposed by the International Society for Technology in Education (ISTE). ISTE has been a source for advocacy, professional development, and support for educators since 1979. ISTE boasts of a membership of over 100,000 educators, media specialist and administrators (http://www.iste.org/news/fact-sheets.aspx).

I viewed my data through the lens of teacher technology leadership practices uncovered by Riel and Becker (2008) and the NETS-T (2008) standards from ISTE. Riel and Becker (2008) identified four practices of teacher technology leaders from survey data of teachers who helped to lead technology. I used the standards (NETS-T) proposed by ISTE (2008) for teacher technology skills in the classroom. NETS-T (2008) acknowledges these skills as vital to the integration and use technology into classrooms.

This study was originally conceived from question**s** raised from my own experiences as a teacher technology leader and from speaking with other technology leaders about the integration of technology. I performed this research in the hopes of improving my own leadership practices with technology by learning through the experiences of other teacher technology leaders. The questions were refined after a review of the literature concerning teacher technology leadership in schools and two interviews conducted with teacher technology leaders for graduate school class projects. These four frameworks (NETS-A, 2009; NETS-T, 2008; Riel & Becker, 2008; Yee, 2000) served as a priori codes for analyzing similarities and differences in the roles of

teacher technology leaders at Laptop Junior High School. The four frameworks, my review of

the literature, and my experience resulted in the crafting of these guiding questions:

- What is the nature of teacher technology leadership at Laptop Junior High School?

- How has the one-to-one laptop initiative changed teacher technology leadership

  practices?

- How do the practices of teacher technology leaders and administrators differ at my

  model school?

Significance of the Study

Some research has been conducted concerning teacher technology leadership in schools

(Dexter, 2011; Luthra & Fochtman, 2011; McLeod & Richardson, 2011; Riel & Becker, 2008).

Using EBSCOhost to search Academic Search Premier and ERIC databases from 2005–2011,

revealed 299 articles using "school leadership and technology" with parameters set to full text

and peer reviewed. Another search of EBSCOhost using the same databases and parameters

returned 50 articles using "teachers and technology leadership." The available research revealed

teacher technology leadership is essential in order to support instruction and the integration of

new technology, while adequately preparing students for life in the 21st century (Dexter, 2011;

Katyal, 2010; Riel & Becker, 2008; Schrum et al., 2011). Riel and Becker (2008) stated,

> The speed of change in technology makes effective use impossible if each teacher has to
>
> learn to use it alone. Without developing and capitalizing on forms of distributed
>
> expertise of teacher leadership, schools will simply be unable to cope with the rapid rate
>
> of change that is required for the use of technology. (p. 415)

My research addresses this need to describe what the "distributed expertise of teacher

leadership" looks like at Laptop Junior High School.

Teacher technology leaders are at the crossroads of technology integration and leadership (Dexter, 2011; Liu, 2010; Prensky, 2010; Riel & Becker, 2008, Sherry & Gibson, 2002). This research extends the research of Riel and Becker (2008) in describing what teacher technology leadership looks like at my model school. My research may assist administrators in making prudent decisions regarding planning, professional development and the possible influence of teacher technology leadership on school culture (Dexter, 2011; Intel, 2008; Riel & Becker, 2008). Schools and colleges may gain a perspective that will assist in the planning of pre-service training and on-going support of teachers and administrators (Dexter, Doering & Riedel, 2006; Donnison, 2007; Gao et al., 2010; Katyal, 2010; Schrum et al., 2011).

Framework for the Study

In examining teacher technology leadership at Laptop Junior High School, I wanted to differentiate teacher technology leadership from administrative technology leadership. I chose Yee's (2000) administrative practices and the NETS-A (2009) standards as lens through which to view my data. Yee (2000) performed a qualitative study of principals in the United States, New Zealand, and Canada who have led the integration of information and communication technology (ICT) in their schools. The principals came from schools where technology was used throughout the school. The principals also had to be active partners with local colleges. Yee's thick descriptions brought to light the practices of principals who were successful in leading the integration of technology. The framework consists of:

Yee (2000)

- Equitable providing
- Learning-focused envisioning
- Adventurous learning
- Patient teaching
- Protective enabling
- Constant monitoring
- Entrepreneurial networking
- Careful challenging

Figure 2. Yee's (2000) Administrative Technology Practices

I also chose view my data with the National Educational Technology Standards (NETS-A) for administrators (ISTE, 2009) in conjunction with Yee's (2000) research. The International Society for Technology in Education (ISTE) serves as a source of professional development resources and leadership since 1979. Membership includes 100,000 educators, library media specialists, technology coordinators, and administrators (http:// http://www.iste.org/news/fact-sheets.aspx). The NETS-A standards (ISTE, 2009) consists of five overarching points. These five standards overlap and support Yee's (2000) eight practices.

NETS-A (2009)

- Visionary Leadership
- Digital Age Learning Culture
- Excellence in Professional Practice
- Systematic Improvement
- Digital Citizenship

Figure 3. National Educational Technology Standards for Administrators (2009)

I chose two frameworks through which to view my teacher technology leadership data. Riel and Becker's (2008) framework for teacher technology leadership was based on their research of professional engagement from the Teaching, Learning, and Computing National Survey. They uncovered four sets of practices for teachers who helped to lead the use of technology in schools. Riel and Becker (2008) uncovered that with the expansion of computer technology into schools "a significant number" of teachers "became strong advocates and leaders for establishing a wider role for computers in the instructional practices of their colleagues" (p. 397). These advocates for technology usage have become teacher leaders in schools. Riel and Becker (2008) identified a model of teacher leadership that consists of four practices.

Riel and Becker (2008)

- Teachers Learning with Technology
- Teachers Collaborating around Technology
- Teachers Networking in Technology-Active Communities
- Teacher Contributing to Knowledge About Educational Technology

Figure 4. Riel and Becker's (2008) Teacher Technology Leadership Practices

I also viewed my data through the five standards ISTE identified for teachers (NETS-T, 2008) integrating and using technology in the classroom. These five standards are described as the "fundamental concepts, knowledge, skills, and attitudes for applying technology in educational settings" (http://www.iste.org/standards/nets-for-teachers.aspx).

NETS-T (2008)

• Facilitate and Inspire Student Learning and Creativity
• Design and Develop Digital-Age Learning Experiences
• Model Digital-Age Work and Learning
• Promote and Model Digital Citizenship and Responsibility
• Engage in Professional Growth and Leadership

Figure 5. National Education Technology Standards for Teachers (2008)

The research of Diane L. Yee (2000) and the NETS-A (2009) standards served as administrative technology leadership a priori codes through which I viewed my interview data. I used these a priori codes in order to identify if any of the administrative practices were in use by the teacher technology leader at Laptop Junior High School. Riel and Becker's (2008) four practices and the NETS-T (2008) standards served as a lens through which I viewed my interview data looking for possible matches and identifying any new practices that would extend theory (Strauss & Corbin, 1990).

Background of the Study

According to Yee (2000), administrators have to locate and provide an adequate number of resources to meet student and teacher needs. Part of this may include networking of partnerships within the community. Developing relationships can lead to collaboration and transparency of school goals and needs. ISTE (2009) recognizes administrators as being the keystone for systematic improvement. Improvement in the Digital Age requires on-going support, timely training, and a plan to guide the refurbishment and renewal of resources. Administrative technology leaders must couple the amount of resources with fair access. Identifying those needs requires in-depth knowledge of instructional requirements and educational trends.

Understanding curricular needs begins with a shared vision for the school (Yee, 2000). ISTE (2009) argues that administrators need to be the torchbearers for communicating and empowering stakeholders in the vision for technology use in the school. Grey-Bowen (2010) contends that liberty in the use of technology in the classroom will empower and encourage experimentation and risk-taking. Experimentation if supported by the principal, can lead to growth of knowledge and expertise (ISTE, 2009; McKenzie, 2002; Yee, 2000). Support generated from being a timely provider builds trust and confidence (ISTE, 2009; Yee, 2000). Administrators will need to model excellence in technology usage, professional knowledge and current trends (ISTE, 2009; Yee, 2000). Finally administrators need to guide the school by crafting a path that blends with the boundaries established by the culture and climate of the school system (Yee, 2000). Administrators should serve as pathfinders in seeking systematic improvement in student learning and technology usage across the curriculum (ISTE, 2009).

Some administrators are not prepared to fully lead the integration and use of technology. The need for teacher technology leaders in schools has arisen because of the lack of technologically savvy leadership and the drive of educational trends towards student-centered instruction in a virtual environment. This shift is a result of our technologically enhanced society and the need to adequately prepare students for the 21st century. Teacher leaders who have technological expertise are essential because of the need to demonstrate and value digital skills (Prensky, 2009, 2010; Riel & Becker, 2008; Roe, 2011; Schrum et al., 2011).

In 2008, Riel and Becker devised a framework for teacher leadership from analyzing the Teaching, Learning, and Computing: 1998 National Survey data. Their results identified four practices of teacher technology leaders. Teachers who learn with technology do so by reflecting upon their own teaching experiences as they move toward an adaptive set of strategies that

support problem solving and flexibility. Riel and Becker (2008) identify these teachers as taking

an "adaptive stance." Part of the flexibility of the "adaptive stance" comes from a professional

commitment to studying technological trends in education. Teacher technology leaders need to

model and support using 21st century tools to explore and solve problems (ISTE, 2008).

Teacher technology leadership also involves collaboration (ISTE, 2008). Riel and

Becker (2008) contend that teacher leaders collaborate and engage in "cycles of inquiry" so that

various learning approaches can be shared. These cycles of inquiry can include observations,

coaching and mentoring. They further argue that if collaboration is already occurring among

teachers within a school, it may spread to cover technology use in the classroom as well.

Sharing of success and failures creates opportunities for increased communication and support

(ISTE, 2008). With technology, Riel and Becker (2008) note technology collaboration can begin

with a simple act of support. Support can be of a technical or pedagogical nature. If the support

is expert, timely and relevant, it can generate social capital that can further the influence of

teacher technology leaders.

Teacher technology leaders also engage in networking with fellow experts in the

professional community. The Internet allows for an easy flow of dialogue among other teachers

and experts in online communities. The online communities represent a platform for teacher

technology leaders to share resources, techniques and lessons with others from around the world

(ISTE, 2008; Riel & Becker, 2008).

The experiences and contributions of teacher technology leaders are often shared through

various digital and professional mediums. Websites such as Edutopia (http://www.edutopia.org)

provide stories and videos of teacher technology leaders sharing their experiences in the

classroom. Conferences and educational journals can provide scholarly insight and further

expertise concerning technological practices in the classroom. Engaging in professional growth can generate durability and self-renewal as an educator while serving as a model for students about the importance of lifelong learning (ISTE, 2008).

Limitations of the Study

One limitation in this qualitative case study is the degree to which the findings from my research can be generalized or transferred to other situations (Kvale & Brinkman, 2009). My case study involves teacher technology leadership practices at Laptop Junior High School. The people, technology, leadership, and school's culture are unique. The findings of my grounded case study may not have external generalizability (Maxwell, 1992) to other schools implementing technology.

Definitions

21st Century Skills – The International Society for Technology in Education (ISTE) has identified the following standards (NETS-S, 2007) as necessary 21st century skills (a) creativity and innovation; (b) communication and collaboration; (c) research and information fluency; (d) critical thinking, problem solving, and decision making; (e) digital citizenship and; (f) technology operations and concepts. Anderson (2008) argues that students will need (a) knowledge construction; (b) adaptability; (c) information retrieval; (d) critical thinking and; (e) teamwork (p. 7).

Digital Age – Also known as the Information Age. The Digital Age is based on access to computerized or digitized information (Larson, Miller, & Ribble, 2009). Tan, Seah, Yeo and Hung (2008) agreed that the Digital Age "is the advancement of computer network technologies, particularly the Internet, which have dramatically changed the ways people are connected, blurring the line between face-to-face and online communication" (p. 249). Dresang (1999)

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described the Digital Age as "the societal landscape that has gradually emerged as computers have become more commonplace and as the Internet has become a locale where children can learn and play" (p. 285)

Distance Learning – The delivery of classes to students who are separated geographically from the classroom (AACSB, 2007; Christensen & Horn, 2008; Deubel, 2003; Hollingsworth, 2011).

Empowerment – Short (1994) contends empowerment is the "process whereby school participants develop the competence to take charge of their own growth and resolve their own problems. Empowered individuals believe they have the skills and knowledge to act on a situation and improve it. Empowered schools are organizations that create opportunities for competence to be developed and displayed" (p. 488). Zimmerman and Rappaport (1988) describe empowerment as the opportunities provided through abilities that provide opportunities for demonstrating those competencies. Li (2010) concurs and described empowerment as the ability of teachers to make decisions regarding their instructional practices that can lead to initiative and expertise.

ICT – Information and Computer Technology (Fitzallen, 2005, Gurr, 2004; Hayes, 2007; Lim & Khine, 2006)

Industrial Age – A period marked by the rise of factories and mass production of goods that effected agriculture, manufacturing, mining, and transportation (Collins & Halverson, 2009).

Interactive Whiteboard – A piece of electronic hardware that connects to a computer. Through the use of an LCD projector the screen becomes the touch-sensitive desktop of the computer (Beeland, 2002; Hall & Higgins, 2005; Wood & Ashfield, 2008; Zevenbergen & Lerman, 2008).

Internet – DiMauro (2009) argues that the threat of a nuclear war with the Soviet Union prompted the formation of the Advanced Research Projects Agency (ARPA). This led to the creation of a communications network (ARPANET) through which government and military computers could communicate under the event of a nuclear exchange. The division (1983) of ARPANET was into civilian and military sections led to the use of Transmission Control Program and the Internet Protocol (TCP/IP). The use of IP addresses coincided with the introduction of personal computers. By 1991, researchers at European Organization for Nuclear Research (CERN) had introduced a web browser, hypertext markup language (HTML) and hypertext transfer protocol (HTTP). These three inventions allowed for the creation of web pages and searchable servers, and the Internet became available to mainstream society.

ISTE – International Society for Technology in Education (Schrum et al., 2011)

Stakeholder – A person with direct interest in an organization (Kopcha, 2008).

Student-Centered Classroom – Education that is centered on the student's abilities and interests. In student-centered learning the teacher is the facilitator of instruction (Sugar & Holloman, 2009).

Tech Goes Home (TGH) – Tech Goes Home is a Boston based organization that provides access, training and hardware to community members to help adults and children learn 21st century skills (DeGennaro, 2010).

Teacher Technology Leaders – Sherry and Gibson (2002) described teacher technology leaders as "active researchers who carefully observed their own practice, collected data, shared their improvements in practice with their peers, and taught new members of their virtual learning community" (p. 182). Riel and Becker (2008, p. 412) identified teacher technology leaders as incorporating the following into their practices:

- Teachers Learning with Technology: Technology leadership evolves from an interest in and ability to incorporate new tools in innovative ways, coupled with a highly reflective and analytic focus on the relative merits of the technology. These teachers constantly explore and refine new ways of making technology useful to their teaching and their students' learning.

- Teachers Collaborating Around Technology: Technology leadership involves frequent exchanges of ideas about educational applications of ICT with other teachers at their school through formal and informal mentoring and coaching and other informal leadership activities.

- Teachers Networking in Technology-Active Communities: Technology leaders participate in networks of technology-using teachers around their district, region, state, and nation, particularly around innovative ways to use technology resources and tools and would have links to sources of expertise about educational technology through their reading and through personal associations with researchers and developers of educational technology products.

- Teachers Contributing to Knowledge About Educational Technology: Finally, technology leadership implies taking an active role in organizations to share knowledge formally through presenting, teaching, and publishing on educational technology issues.

Virtual – Computer generated (Sanchez, 2009).

Web 2.0 – Web applications that allow the user to participate. This is most often referred to as user-generated content on websites. Web 2.0 includes cloud computing and storage (Albion, 2008).

Wikis – Websites that allow for the creation and editing of web pages by multiple authors (Klobas, 2006; Roe, 2011).

Summary

As classrooms become interactive, digital environments, students will have greater access to collaborative and communicative tools. Technology, if properly supported, can present schools with an opportunity for student-centered engagement with 21st century resources (Cisco, 2008; Jukes, McCain & Crockett, 2010; Prensky, 2007, 2009, 2010; Smith, Higgins, Wall & Miller, 2005; Wood & Ashfield, 2008). Laptop Junior High School has implemented a one-to-one laptop initiative to prepare students for life in a digital society. Technologically savvy leadership is necessary in order to launch and support an extensive technological project (Bonifaz & Zucker, 2004; Cisco, 2008; Intel, 2008; Penuel, 2006; Weber, 2009). I am researching what teacher technology leaders look like at Laptop Junior High School. My case study of teacher technology leadership practices brings to life the rituals, routines and everyday examples of what teacher technology leadership at Laptop Junior High School.

Chapter 2 will provide a foundation for my case study grounded in administrative and teacher technology leadership research. Chapter 2 addresses the administrative technology leadership practices uncovered by Yee (2000), and the administrative skills and competencies identified by NETS-A (2009). Chapter 2 will explore the standards of teacher technology skills and competencies identified by NETS-T (2008) and teacher technology leadership practices researched by Riel and Becker (2008). Chapter 3 will describe my research methodology and participants. Chapter 4 will report on the findings of my research and Chapter 5 contains my summary, interpretations and conclusions.

CHAPTER 2: REVIEW OF THE LITERATURE

Introduction

Riel and Becker (2008) argued that a "distributed expertise of teacher leadership" (p. 415) was necessary in order for schools to successfully integrate technology. My research further pursues their conclusions. The purpose of my case study was to investigate what teacher technology leadership looks like at Laptop Junior High School. I also wanted to identify how the practices of teacher technology leaders differ from administrative technology leadership practices.

Yin (2003) argued a framework is a valuable tool in case study research. Frameworks serve as a lens for viewing and interpreting data. This chapter provides a review of the literature regarding the frameworks I used as a lens to view the practices of administrative and teacher technology leaders who direct the integration and support of technology in schools.

Chapter 2 is divided into two major sections. The first section covers literature regarding administrative technology leadership practices. I viewed my data through Yee's (2000) framework of administrative technology leadership and the National Educational Technology Standards for Administrator's (NETS-A) proposed by the International Society for Technology in Education (ISTE) in 2009. Diane L. Yee (2000) performed a qualitative study of principals in Canada, New Zealand, and the United States who lead the integration and use of technology (ICT) in schools. Yee (2000) collected thick descriptions of the daily trials of principals providing, using, and supporting technology in schools. From her immersion in the schools, Yee

(2000) identified eight practices of principals leading the use of ICT in schools. I also viewed my data through the framework of administrative technology leadership (NETS-A) standards identified by ISTE (2009). The International Society for Technology in Education was established in 1979 as an organization to advance and advocate the use of technology into schools (http://www.iste.org/news/fact-sheets.aspx). Under the leadership of Dr. Don Knezek, the organization worked to promote "classroom transformation by ensuring that digital age students are empowered to learn, live, and work successfully today and tomorrow" (http://www.iste.org/standards.aspx).

The second section of Chapter 2 covers the practices of teacher technology leaders in championing and supporting the use of technology throughout the school (Dexter, 2011; ISTE, 2008; Luthra & Fochtman, 2011; Riel & Becker, 2008). Riel and Becker (2008) believed that teacher technology leaders could exude influence school culture. Their research using the 1998 Teaching, Learning, and Computing National Survey (http://www.crito.uci.edu/tlc/html/ tlc_home.html) resulted in the identification of four practices of teacher technology leaders (Riel & Becker, 2008).

I also included the National Educational Technology Standards for Teachers (NETS-T) for educators (ISTE, 2008) as a lens for viewing my research data. The NETS-T standards provided a framework of five standards that outlined the skills and concepts for integrating and using technology in 21st century classrooms. These four frameworks: (a) administrative technology leadership practices uncovered by Yee (2000); (b) NETS-A standards for administrators (2009); (c) teacher technology leadership practices researched by Riel and Becker (2008) and; (d) the five teacher technology standards set forth in 2009 by NETS-T, served as a lens through which I viewed my data.

21st Century Skills

Technology has become intertwined in all aspects of our society (Cisco, 2008; Prensky, 2010). The Department of Education (2003) contended, "Technology is now considered by most educators and parents to be an integral part of providing a high-quality education" (p. 3). Student-centered, technologically integrated classrooms are needed to adequately prepare students to be competitive in a digital society (Cisco, 2008; Girod & Cavanaugh, 2001; Intel, 2008; Prensky, 2007; Silva, 2009). The Partnership for 21st Century Skills is a league of business leaders that have worked with schools throughout the nation to promote a curriculum that includes media literacy, communication, teamwork, and problem solving skills that can lay a foundation for success in the workplace (Gewertz, 2008). The Partnership for 21st Century Skills (http://www.21stCenturySkills.org) proposed that students need the following skills in order to be prepared for the virtual and global workplace.

21st Century Skills

- Creativity and Innovation
- Critical Thinking and Problem Solving
- Communication and Collaboration
- Information Literacy
- Media Literacy
- Information, Communication and Technology (ICT) Literacy

Figure 6. 21st Century Skills (http://www.21stCenturySkills.org)

Schools are responsible for incorporating these 21st century skills across the curriculum into student-centered classrooms (Bell, 2010; Jukes, McCain & Crockett, 2010; Liu, 2010; McLeod, 2011; Pappas, 2009; Prensky, 2009, 2010). Some schools have turned to one-to-one laptop initiatives as a platform for integrating 21st century skills into instruction (Garthwait &

Weller, 2005; Goodwin, 2011; Keengwe, Schnellert & Mills, 2011; Penuel, 2006; Silvernail, 2011).

One-to-one Laptop Initiative

Lei and Zhao (2008) researched a middle school, one-to-one laptop initiative, located in the Midwestern United States. They conducted surveys and interviews of teachers, students, and parents. Their research investigated the possible effects of a laptop initiative program on teacher pedagogical practices. The results of their research revealed that most students (81.4 percent) used the laptops for homework, 71 percent for research and 65 percent for communication. Lei and Zhao (2008) revealed "student laptop uses were very imaginative, creative, and diverse. Students used the digital tools to solve many daily problems, including doing homework, searching for information on school work, communicating with friends, developing personal interests, exploration, and having fun" (p. 117). Eric Weber (2009) reported similar results from seventh and eighth grade students in a middle school. Weber (2009) stated the laptops provided "anytime access to technology tools and educational software…" (p. 28). He concluded that the one-to-one laptop program supported "the acquisition of skills that are needed in the workplace" (p. 28). Windschitl and Sahl (2002) reported, "More than a thousand schools nationwide have committed themselves to some form of laptop computer initiative, and the number is increasing rapidly" (pp. 165–166). Laptop initiatives have proven to be tools in helping students gain experience with technology (Garthwait & Weller, 2005; Goodwin, 2011; Keengwe, Schnellert & Mills, 2011; Penuel, 2006; Silvernail, 2011).

Proponents of laptop initiatives argued such plans to be a holistic solution, providing students with needed technology skills and expertise across the curriculum (Bebell & Kay, 2010; Donovan & Strudler, 2007; Weston & Bain, 2010). In 2005, Laptop School District launched a

system-wide plan to prepare their students with the necessary technological skills for life in the 21st century (Intel, 2008). The groundwork for their one-to-one laptop program started with leadership (Anderson & Dexter, 2005; Dexter, 2011; Katyal, 2010; McPherson & Borthwick, 2011; Prensky, 2007; Riel & Becker, 2008).

Technologically savvy leadership is needed in leading schools in the integration and use of technology (Anderson & Dexter, 2005; Dexter, 2011; Schrum et al, 2011; Yuen, Lee & Law, 2009). Technology leadership is not limited to administrators (Flanagan & Jacobsen, 2003; Luthra & Fochtman, 2011; Riel & Becker, 2008; Sherry & Gibson, 2003). There is a good deal of literature regarding the administration's role in leading technology in schools (Afshari, Bakar, Luan, Samah & Fooi, 2009; Dawson & Rakes, 2003; Gurr, 2004; Leonard & Leonard, 2006; Moyle & Webb, 2005; Orrill, 2001; Yee, 2000). Some research has been conducted regarding teacher technology leadership in schools (Dexter, 2011; Luthra & Fochtman, 2011; McLeod & Richardson, 2011; Riel & Becker, 2008; Sherry & Gibson, 2003). An investigation of Academic Search Premier and ERIC databases uncovered 299 articles using "school leadership and technology" as search terms. Using the identical databases and the search terms "teacher and technology leadership" resulted in 50 articles. The research addressing teacher technology leadership stresses that teacher leadership is needed to support the instructional use of technology throughout the school, and to better prepare students to be 21st century workers on a global stage (Dexter, 2011; Cisco, 2008; Katyal, 2010; Prensky, 2007, 2009; Schrum et al., 2011). Riel and Becker (2008) concluded that teachers who work alone to integrate technology into their classroom would suffer difficulty due to the rapidly changing technological landscape. They argued that a "distributed expertise of teacher leadership" (Riel & Becker, 2008, p. 415) is necessary to effectively integrate technology into classrooms. My case study follows-up on their

research by investigating what teacher technology leadership looks like at Laptop Junior High School.

The Need for Technology Leadership

The need for technologically minded leadership in schools has arisen because of the pedagogical shift that is occurring in classrooms (Cisco, 2008; Jukes, McCain & Crockett, 2010; McAfee, 2006). Many school leaders are woefully unprepared to serve their stakeholders as instructional leaders who understand the values and demonstrate 21st century skills (Flanagan & Jacobsen, 2003; Gurr, 2004). Yet, it is the leader's responsibility to reach across this gap in knowledge and lead the implementation of technology in the school (Anderson & Dexter, 2005; Schiller, 2003; Willmore & Betz, 2000). According to Flanagan and Jacobsen (2003), teacher technology leaders are arising from classrooms, libraries, and computer labs to assist administrators in fully leading technology into the classroom. Flanagan and Jacobsen (2003) strike to the heart of this topic:

> Very few principals have themselves used computers in meaningful ways with children, and therefore lack the requisite pedagogical vision and experience to guide teachers. Consequently, in many schools, informal leaders have emerged from classrooms, libraries and computer labs to take up the difficult task of planning for technology integration, and supporting distributed and often-uncoordinated efforts by enthusiastic teachers. Unfortunately, technology planning has too often been limited to the goal of acquiring hardware and software. Schools have focused on purchasing equipment, setting up labs and wiring their buildings, without considering the substantial organizational and cultural changes that are necessary to support appropriate use of technology to enhance student learning. (p. 127)

Teacher technology leaders find themselves at the intersection of leadership and technology (Dexter, 2011; Katyal, 2010; Pulley, McCarthy, & Taylor, 2000). Teacher technology leadership practices may help in changing school culture to embrace technological change (Riel & Becker, 2011). These teacher technology leaders serve as engineers to bridge the gap between the last remnants of the Industrial Age and new organizational structures of the Digital Age. In order to investigate the role of teacher technology leadership at Laptop Junior High School, I viewed my data using two frameworks from Yee (2000) and NETS-A (2009) as lens for the role of administrative technology leadership. I used the frameworks of Riel and Becker (2008) and NETS-T (2008) as a lens for examining my teacher technology leadership data.

The International Society for Technology in Education (ISTE) identified five overarching practices for administrators (NETS-A, 2009) leading the integration and use of technology in schools. These five standards were derived from input from the organization's professional membership (http://www.iste.org/standards.aspx). The five standards are:

- Visionary Leadership – lead the shared vision for technology usage.

- Digital Age Learning Culture – create and promote a technologically enhanced culture that supports the learning needs of 21st students.

- Excellence in Professional Practice – promote a professional environment that supports the use of digital resources in the classroom.

- Systematic Improvement – administrators provide constant monitoring to move the incorporation and use of technology resources forward.

- Digital Citizenship – administrators serve as models for the use of technology. By modeling they serve promote safe practices.

Yee (2000) investigated the practices of administrators as technology leaders by studying the experiences of principals in ten technology-endowed schools in the United States, Canada and New Zealand. The participating principals were considered technologically savvy leaders by their own co-workers and through partnerships with higher learning institutions. Yee's (2000) thick descriptions uncovered the practices of principal that experienced success in integrating technology. Eight characteristics arose as themes from the language of the interviews. The eight descriptors were:

Yee (2000)

- Equitable providing
- Learning-focused envisioning
- Adventurous learning
- Patient teaching
- Protective enabling
- Constant monitoring
- Entrepreneurial networking
- Careful challenging

Figure 7. Yee's Administrative Technology Practices (2000)

Equitable Provider

One of the first jobs of an administrator as technology leader is to provide access to technology, planning that supports a flexible schedule, timely professional development and modeling of technology usage (Anderson & Dexter, 2003; Gurr, 2004; Wozney, Venkatesh & Abrami, 2006; Zevenbergen & Lerman, 2008). Administrators need to provide and manage an adequate amount of student-centered resources in order to promote Digital Age culture and citizenship throughout the school (ISTE, 2009). Yee (2000) discovered the term equitable provider to describe fair-minded access to technology in classrooms, library media centers, and computer labs.

Lack of access to necessary technology infrastructure can serve as a powerful barrier to the use of technology in schools (Kopcha, 2008, Yee, 2000). Lim and Khine's (2006) study of four Singapore schools reinforces the notion that teacher technological practices were more successful in schools where (a) technology experts were in place, (b) the equipment was well maintained and current, and (c) the teacher and students knew simple troubleshooting techniques. Outdated and malfunctioning equipment lead to frustration (Fitzallen, 2005; ISTE, 2009; Kopcha, 2008; Lim & Khine, 2006; Yee, 2000).

Equitable providing begins with a technology plan that guides technology maintenance and renewal (Brzycki & Dudt, 2005). Technology planning needs to provide an equitable amount of equipment (Ertmer & Ottenbreit-Leftwich, 2010) in order to alleviate student and teacher frustration (Brzycki & Dudt, 2005). The administrator's role is to lead the formation of a technology plan that will support a current infrastructure through maintenance and consistent funding (ISTE, 2009).

An equitable provider also understands the importance of scheduling and time in providing for student use and teacher planning and professional growth (ISTE, 2009). Rigid schedules can interfere with technology-centered lessons (Clifford, Friesen & Lock, 2004; Lim & Khine, 2006). Fitzallen (2005) noted in her qualitative study of four teachers that access to the computer lab was identified as being a hindrance. The computer lab did not have an adequate number of machines and the lab schedule hampered student projects. Labs that are centrally accessible and managed with a flexible schedule allow users greater access and opportunities (Yee, 2000). Equitable providers should be flexible schedulers in order to meet student and teacher needs.

Flexible scheduling should also apply to providing timely professional development for teachers (Flanagan & Jacobsen, 2003).   In their research of schools in Alberta, Canada, Flanagan and Jacobsen (2003) uncovered that there was a lack of funding for adequate professional development opportunities. The researchers reported that in-service technology training opportunities often focused on basic computer skills instead of the integration of the technology into the curriculum. Grey-Bowen (2010) argued that administrators should strive to provide professional development opportunities that focus primarily on student achievement and not basic computer use. According to Thomas and Knezek (1991) professional development opportunities for educators should begin with support at the preservice level and be ongoing throughout a teacher's career. As teachers stay current with trends in technology, they will play an increased role in determining future professional development opportunities (Hall & Higgins, 2005). Teachers increased role in mastering technology will ensure the effective use of technology across the curriculum (ISTE, 2009).

ISTE (2009) argued administrators need to model technology use. Modeling may help administrators stay current with technological trends in education. Modeling will help to ensure a focus on improvement that encourages timely professional development (Dexter, 2011). Yee's (2000) study also identified flexible scheduling of professional development opportunities as critical to teacher training. Yee (2000) discovered that many of the administrators interviewed restructured teacher schedules to provide more opportunities for technology training. Administrator should provide an equitable amount of technology. Access to technology should include planning, flexible scheduling, and timely professional development. Administrators should also serve as models for technology usage throughout the school. By serving as a model, school administrators are working to promote a vision to all stakeholders.

Learning-focused Envisioning

Learning-focused envisioning involves the administrator being a keeper of the school's vision and a model for shaping teacher beliefs. Grey-Bowen (2010) argued that communicating a shared vision throughout the school and to all stakeholders is of vital importance to successful leadership. A shared vision should "maximize the use of digital-age resources" (ISTE, 2009). Hanna (2008) proposed that administrators help "develop a vision of a knowledgeable society" that will "set policies and priorities." Administrators need to possess an understanding of current and future trends and a have vision for technology usage (Cisco, 2008; ISTE, 2009; Marx, 2006; McLeod, 2011; Prensky, 2000, 2009; Senge, 1990). Student achievement and the blending of 21st century skills across the curriculum is also a major concern of administrators (McLeod, 2011; Moyle & Webb, 2005; Prensky, 2009, Silva, 2009).

The school's vision should include the role technology has in the educational process (ISTE, 2009). The support of technology integration into the classroom by the administration at the local and system level sends a message to all stakeholders about the role of technology in the school system (Hornbeck, 2010; Katyal, 2010; Larson, Miller, & Ribble, 2009). A technology plan should be based upon the school's shared vision (ISTE, 2009). The shared vision can in part be derived from action research aimed at finding solutions to educational needs (Riel & Becker, 2008). The research should include an investigation of new technologies available to educators. Workshops, technology conferences, journals, and cutting-edge web sites should provide insight into new equipment and software (Flanagan & Jacobsen, 2003). A technology plan needs to identify short and long-range instructional goals. Identifying instructional goals, technology requirements and support is essential in meeting student and teacher needs (Flanagan & Jacobsen, 2003). A technology plan provides support because the plan evolves to meet

student and teacher needs. These goals can include (a) hardware and software purchases, (b) mobile and computer labs, (c) interactive technology, (d) budgeting, (e) continuous professional development, and (f) support and evaluation. Flanagan and Jacobsen (2003) argued that a shared vision created with the assistance of all stakeholders can lead to a sense of ownership in the technological achievements of the school and can help alter teacher beliefs (Blasé & Blasé, 1996; Gurr, 2004; Somech, 2005).

Teacher beliefs can have a profound effect on the integration of technology (Starkey, 2010). Beliefs are the personal thought and feelings that teachers have about technology and the possible role it could play in the classroom (Sime & Priestley, 2005). According to Kagan (1992), teacher beliefs are defined as "tacit, often unconsciously held assumptions about students, classrooms, and the academic material to be taught" (p. 65). Experience and beliefs are locked in a mutual dance that can influence teacher practices (Starkey, 2010). Teacher beliefs and their experiences play a critical role in the integration of technology and the willingness to make a shift toward student-centered, technologically laden practices. Culp, Honey and Mandinach (2005) propose that without imaginative leadership and vision, technology will simply reinforce current teaching practices in the classroom. Alkire (1995) argued that leadership may need to establish "new traditions" (p. 2) and "re-negotiate cherished myths, sacred rituals and traditions" (p. 2). Lim and Khine (2006) stress that the key to integrating technology in schools lays squarely on the shoulders of the educator. Teacher choice of technology is important in insuring that technology is successfully used in the classroom (Zhao, Pugh, Sheldon, & Byers, 2002). According to Ertmer and Ottenbreit-Leftwich (2010), teacher core beliefs may be the most difficult to alter. Successful experiences are needed in order to successfully sway teacher beliefs.

Judson (2006) reported that gauging teacher beliefs towards technology usage is sometimes difficult to measure. Ottenbreit-Leftwich, Glazewski, Newby and Ertmer (2010) argued that if technology is held in high regard by the teacher the tool may prove invaluable to instruction. Placing technology in a positive light is the role of the administrator. The principal will have to provide positive experiences and timely support in order to shift teacher beliefs about technology in the classroom. Positive experiences with technology can change teacher beliefs (Hall & Higgins, 2005; Hew & Brush, 2007; Hughes, 2005).

Adventurous Learning

Adventurous learning involves the administrator as a teacher and student, who demonstrates a willingness to master and then share technology skills with others. "Adventurous" describes the principal's openness to experiment with different strategies and technologies. One of the first steps towards leading technology use involves immersing oneself into the technology (Yee, 2000). According to McKenzie (2002), the more knowledge and experience the administrator has about technology, the more capable they will be in implementing and evaluating technology usage in the classroom and altering the school's culture towards acceptance of new digital tools.

A school's culture is defined as the values, beliefs and teacher practices (Zhao, Pugh, Sheldon, & Byers, 2002). The nature of the product renders most technology obsolete in rapid fashion. The issue with integrating is not so much the particular tool, but the way it is implemented in the school. When projects and lessons extend beyond what is normally done at the school, the project or lesson has an increased chance of not being successful (Zhao, Pugh, Sheldon, & Byers, 2002). Implementation falls to the leader (Alkire, 1995). Leadership sets the undercurrent for expectations within the schools culture. Leadership sets in place the practices

that help shape the culture (Alkire, 1995). Part of the reason behind why technology is not fully

utilized is often due to the culture of the school (Zhao, Pugh, Sheldon, & Byers, 2002). Ertmer

and Ottenbreit-Leftwich (2010) argue that if culture is not receptive to change, teachers wanting

to adapt technology into their practices may have a difficult time. The peer influence of other

teachers on what constitutes best practices within a department, grade, or school can stifle

integration and experimentation. Sime and Priestley (2005) noted that teachers who used

technology in isolation felt pressure from educators who did not use technology. The educators

in the study who did not use technology were reported as being older and having little to no

experience using technology (Sime & Priestley, 2005). Student teachers reported the following

practice to encourage participation:

> Regarding age and attitudes towards computers, there did seem to be some correlation
>
> between these in my school. Older teachers were far more reluctant to use it. For those
>
> of us who are not comfortable with technology, it is important to be eased in gently. ICT
>
> has to be promoted to technophobes as positive as time saving. It is also really important
>
> to have adequate support for staff. (Sime & Priestley, 2005, p. 138)

Ertmer and Ottenbreit-Leftwich (2010) contend that the leader's vision of the school and how

instruction should be delivered is of critical importance.

Administrators can influence the culture of a school by working with empowered

stakeholders to create a shared vision. A shared vision should include the importance of

technology to the well-being of student learning. Administrators should also work to provide

infrastructure and support so that teachers and students have a positive experience.

Experience is one of several interlocking factors that influence culture. According to

Waldron and McKleskey (2010) leadership must also engage educators in questioning their

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beliefs and strive to create a "collaborative change process that results in new values, beliefs, norms, and preferred behaviors" (p. 59). Administrators will need to encourage on-going professional development that addresses individual needs and a restructuring of school culture (Fullan, 2007).

Ertmer and Ottenbreit-Leftwich (2010) believed that future teachers grounded in student-centered technology instruction would impact school culture and help shape beliefs by serving as models. Technology leadership seeds can be sown during preservice training (Brinkerhoff, 2006; Zhao & Frank, 2003). Institutions of higher learning will need to insure that preservice field experiences include placing student teachers in schools where there is a culture that supports the technological needs of students (Bauer & Kenton, 2005; Brinkerhoff, 2006; Thomas & Knezek, 1991).

Patient Teaching

Patient teaching concerns administrators who provide technology instruction to any and all interested stakeholders. Yee (2000) discovered descriptions of administrators who were "very keen to teach." "Patient" implies that the administrator is thoughtful and understanding of requirements and time constraints.

Lim and Khine (2006) contended that time is one of the top ten problems involving the use of technology in teaching. Lane and Lyle (2009) concurred that some of the faculty at the University of Washington identified "lack of time or knowledge" as the biggest stumbling block to technology usage in the classroom. Bauer and Kenton (2005) argued that preparing lessons centered on computer technology, often consumed more preparation time because of the need of creating a second set of lesson plans in case of a technical problem. Teachers also reported a lack of instructional time when working with an insufficient amount of equipment for the class

size. Fitzallen (2005) concurred that teacher workload and preparation time hampered the ability

to locate Internet resources and create learning programs. The four teachers in her study had to

create most of their technology infused lessons at home. Norum, Grabinger and Duffield (1999)

argued for adequate planning professional development time during the school day. Lim and

Khine (2006) recommend that block scheduling may be one means to assist teachers in preparing

lessons. They also recommend bringing in volunteers and having "professional development

days" (Lim & Khine, 2006, p. 4). Most teachers who find success using technology do so in

small steps. Yee (2000) reports one leader that made educational technology "instruction very

available to absolutely everyone who wanted it, and if you couldn't come at those times he

would sit down with you at noon hours and show you how to do those things." Such deep caring

and willingness on the part of administrators may effect change (Senge, 1990). Such change in

school is necessary for the search for personal mastery and the creation of lifelong learners

(Senge, 1990). Administrators need to lead the usage of technology by supportive planning and

a willingness to model technology usage in the school (ISTE, 2009).

Protective Enabling

Protective enabling concerns the creation of leadership opportunities for teachers and

students. Empowerment of students and teachers leads to a sense of ownership in the use of

technology in the school (Yee, 2000). As empowered stakeholders become aware of new

developments in technology, they can play a role in the planning, purchase and integration of

new tools into the school (Thomas & Knezek, 1991). The protective part of the label involves

the removal of roadblocks and putting support in place to encourage others. Providing an

atmosphere for creative collaboration, communication, praise and support, encourages student

and teachers to become technology leaders (Wenger, White & Smith, 2009).

Constant Monitoring

Constant monitoring is part of enabling and is necessary to ensure that instruction is in line with the vision and goals of the school (ISTE, 2009; Yee, 2000). According to Walvoord, et al. (2008), administrators are responsible for keeping members informed. This information should include keeping the vision of the organization at the forefront. Administrators need to maintain a clear focus on student achievement and 21st century skills in each classroom. Observation and communications between stakeholders about classroom expectations builds trust and accountability (Walvoord, et al., 2008).

According to Grey-Bowen (2010), administrators should use technology to assess the effectiveness of teaching. Abrams and Russell (2004) reported in their study of twenty-two Massachusetts school districts that most principals give some form of consideration to teacher technology usage in instruction during observations. They also reported that two-thirds of principals have a system in place for evaluating technology usage during an observation. Analyzing electronic score results and other data can help leaders concentrate assistance to areas of improvement. The U.S. Department of Education (2010) argued eighty-seven percent of public schools use the Internet to access and share standardized test results with the faculty. Assessment should help guide planning for professional development and identify classroom resource needs.

Assessment data is also important in formulating strategies for learning. The U.S. Department of Education (2010) reports that eighty-five percent utilize online data from standardized assessments to plan teaching strategies. Assessment and action based research are vital components of school improvement. As classrooms begin a pedagogical shift in student-centered practices, assessment can play a helpful role in determining the effectiveness of the

strategies and can help guide future instruction. Student and teacher empowerment in the process is necessary to encourage experimentation, ownership and growth. Deboer (2002) argues that self-reflection helps students gain a better understanding of ideas especially if the learning is self-directed.

Assessment is also a part of mentoring. Teachers who mentor and co-mentor should keep reflexive journals of their learning experiences (Franklin et al., 2001; Kochan & Trimble, 2000; Kopcha 2008). Wright and Wilson (2006) note in their study of preservice teachers that reflections on teaching experiences and artifact collection was pertinent to understanding classroom instruction. Sime and Priestley (2005) report that student teachers found reflecting on observed teacher practices using technology to be more beneficial than seminar discussions in a college classroom. Administrators need to encourage teachers and students as they engage in using technology to keep a reflexive journal in order to assess the learning that has occurred and gain insight and improvement in teaching practices (Franklin et al., 2001).

Entrepreneurial Networking

Entrepreneurial networking describes the partnerships administrators need to build with community members in order to secure adequate support for the program. Warren (2005) proposes that schools partner with the community in order to build networks of relationships that can help ensure academic and community progress. Communication and collaboration is necessary to meet the vision and goals of the school (Sagor, 2004). Emails, blogs, tweets and web pages can provide timely communication with the community that can lead to an awareness of needs and confidence in the school. Experimentation and courageous teaching with an awareness of community needs can build confidence and support. Trist (1981) espouses the merits in the "replacement of a climate of low-risk taking with one of innovation. This implies

high trust and openness in relations…this transformation is imperative for survival in a fast-changing environment" (p. 44). Such leadership is necessary in adapting to meet the ever-changing needs of students.

According to the National Telecommunications and Information Administration (2000) a "digital divide" runs along "gender, socio-economic status and cultural lines." Students from families of low socioeconomic status, enrolled in schools having less than adequate funding, may have little exposure to current technology (Flanagan & Jacobsen, 2003; Mentz & Mentz, 2003). Celano and Nueman (2010) report that only 15 percent of students living in households with incomes averaging around $25,000 had a personal home computer. Of the 15 percent, only 35 percent had a broadband Internet connection. Lower income students without a home computer must rely on community resources such as the public library or charitable societies such as the Salvation Army to provide access. Celano and Nueman (2010) suggest that schools that serve large numbers of low-income students work to provide greater access to technology. Computer labs and teacher assistance should be made available to students during after-school hours, weekends, and during the summer break.

In a study performed in the Mississippi Delta, Thomas (2008) reported that lower income students do not have the same level of access or skill sets as students from middle and upper income families. Thomas (2008) argued that it was the ethical responsibility of schools to provide the necessary amount of equipment in classrooms and labs and make it accessible to all students. She also recommended that national technology standards be implemented when planning classroom lessons. By including technology as a tool for instructional delivery, students will have more exposure and opportunities for interaction.

An outstanding example of community stakeholder involvement comes from the DeKalb County School District in Atlanta, Georgia. The Family Technology Resource Centers Program is comprised of fourteen buildings that serve the underprivileged. The goal of the program is to provide access, training, and support for community stakeholders in the use of technology. The program is the result of stakeholders identifying community needs and school resources and incorporating them into the school's vision (O'Neil, 2003).

De Gennaro (2010) reported that Boston, Massachusetts has a citywide after-school program called Tech Goes Home (TGH). The city has provided more than 5,000 computers and placed them in public schools. Middle school students and their parents can attend 25 hours of classes. When the training regimen is complete, parents are given the opportunity to purchase the computers for as little as $50. Parents in these lower income neighborhoods can also have access to wireless Internet for as low as $10 a month. Attendance in these afterschool classes is based on order of arrival. Tech Goes Home provides students and parents with access to training and hardware at home that might not be readily available. Public school teachers provide the TGH training.

Tech Goes Home is targeted at assisting lower-income students and those who are struggling academically. TGH is part of the shared vision of the participating schools. The Lilla G. Frederick School in Boston has a curriculum that is geared towards 21st century skills. Teachers have made a pedagogical shift towards incorporating technology into student-centered classrooms. Part of the rewards of this partnership is that students are empowered as technical experts to assist their parents in learning about technology (De Gennaro, 2010).

Finally Czarnecki (2009) related how the Scott County Schools in Georgetown, Kentucky have partnered with the public library to create computer videos that would archive community

storytellers. Students, teachers, public librarians, and local storytellers partnered together to

create these student-made videos that are now posted on the library website. Teachers felt that

this was an important experience for students. Students were able to better understand the

history of the area while gaining an opportunity to increase their expertise in technology and

communication skills. Student work on this project belongs to the standards suggested by the

International Society for Technology in Education (ISTE). Students (a) demonstrated creative

thinking, (b) worked together collaboratively, (c) gained a greater fluency with digital tools, (d)

used critical thinking skills to plan and manage the project, and (e) were able to relate the project

to societal issues.

  According to Thomas and Knezek (1991), schools finding success with technology were

parlaying that success into private and public grant funds. Resource sharing may also be a viable

option to meeting growing educational needs. Administrators should strive to keep the

networking of community resources and the management aspects of technology in line with the

goals of the school (Clifford, Friesen & Lock, 2004). The Annenberg Institute for School

Reform (1998) argued that partnering with community members is a "purposeful effort, starting

in either the school system or the community, to build a collaborative constituency for change

and improvement" (p. 9). The institute contends that such partnerships can lead to (a) innovative

thinking, (b) problem-centered research, (c) adequate financial support, and (d) sustained

engagement (Simmons, 2005). According to Yee (2000), some of the leaders interviewed

described partnerships that would support student learning and partners would see a return in

their investment through future potential employees. Such collaborative efforts make a school

system attractive to potential industry. SEIRTEC (2000) argued that developing relationships

with technology experts in the community could help support learning and assist in maintaining

the technological infrastructure. Such joint efforts might also benefit other entities such as the public library, hospital or local community college.

Careful Challenging

Careful challenging involves leaders and teachers thinking "outside the box" and "challenging assumptions." Girod and Cavanaugh (2001) argued that educators must be the ones to "push new boundaries of knowledge, resources, and content" (p. 2). Careful challenging takes a willingness to push the boundaries of the envelope. At the same time, the administrator displays an understanding of the political climate and how much risk-taking would be permitted.

Teacher Leaders

A school's culture is defined by the shared vision, goals, beliefs and experiences of the teachers. A school's culture in turn can color the educational process and assist or hamper adaption of new teaching practices and technology. It is the role of leaders to introduce new traditions, which may improve student learning. Altering a school's culture to improve student learning can involve more than the administration (Ertmer & Ottenbreit-Leftwich, 2010; Zhao & Frank, 2003). Teachers, who have limited professional engagement with other educators and tend to place most of their focus on their own classroom, exhibit little influence toward improving schoolwide student success (Roby, 2011). Educators who have a sense of ownership and a moral sense of responsibility may help administrators lead the school in bringing about a cultural shift. Diana (2011) defined teacher leaders as those who develop the knowledge and abilities to implement change throughout the school. Teacher leaders "must be involved in creating and supporting a cultural shift if it is to take hold" (Roby, 2011, p. 782). Teachers who experience this obligation to change will work actively with others to build professional relationships. Crippen (2010) stated "teaching is all about making connections with people. It is

about relationships and investment in others and their future and ours" (p. 27). Riel and Becker

(2008) identified teacher leadership with a willingness to encourage professional relationships

with other educators. Engaging other educators in discussions can include online learning

communities, and professional organizations. Riel and Becker (2008) identified four practices

that describe teacher leadership.

Riel and Becker (2008)

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• Learning from One's Own Teaching
• Collaborating and Sharing Responsibility for Student Success
• Participating in Geographically Diverse Communities of Practice
• Making Personal contributions to the Teaching Profession
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Figure 8. Riel and Becker's (2008) Teacher Leadership Practices

These four practices were based on their findings from the Teaching, Learning, and

Computing National Survey (1998) concerning professional engagement. Riel and Becker

(2008) discovered four sets of practices for educators who assisted in leading the integration of

technology in schools. They uncovered that in schools where technology had an increased role

in the classroom, there was a number of teachers who "became strong advocates and leaders for

establishing a wider role for computers in the instructional practices of their colleagues" (p. 397).

Teachers that learn from their own teaching in order to improve strategies of student

instruction are teacher leaders. Reflectivity and adaptability encourages designing an ever

changing set of strategies that support problem solving. Teacher leaders share these findings

with other instructors to improve learning throughout the school.

Teacher leaders can also learn and share with others by collaboration, observation, and

discussion. Visiting other classrooms, presents teachers with an opportunity to openly discuss

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and improve teaching practices. Visits may result in feedback that generates professional development opportunities. Mentoring and peer coaching can assist in refining teaching techniques, providing support for experimentation, sharing ideas, and information (Riel & Becker, 2008).

Teacher leaders not only influence the educational process in their own school but can also serve as a source for imaginative practices and problem solving solutions at other schools. Riel and Becker (2008) referred to teacher leaders as being "conduits for the movement of new ideas between schools. They do this by joining professional organizations, attending conferences, and participating in communities of practice with teachers in distant places" (p. 402).

Teacher leadership can move beyond the school to influence and contribute to the professional community-at-large (Gilles, Wilson, & Elias, 2010). Teacher leaders can add to the education body of knowledge by authoring articles, textbooks, and designing curriculum materials. Riel and Becker (2008) suggested that knowledge building might lead to a deeper "contextual knowledge of practice to provide insights that will lead to more general understanding of pedagogy" (p. 402). The higher academic efforts of teacher leaders can serve to not only gain a greater knowledge about education in general, but may also lead to problem solving on a larger scale through action research. Teacher leaders using action research may help transform the power structure in schools (Diana, 2011; Gilles, Wilson, & Elias, 2010; Riel & Becker, 2008).

Diana (2011) argued that action research is the means through which teachers can link proven methods with student data to improve student learning. The responsibility of preparing teachers to conduct action research will in part fall to collegiate institutions (Diana, 2011).

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Institutions of higher learning will need to bridge the gap between the theoretical realms of upper academics and the practical realities of the classroom (Smeets & Ponte, 2009; Williams, Foulger & Wetzel, 2009). Teacher leaders who use action research can serve a pipeline to bring relevant, current research into schools. Sagor (2000) noted that action research promoted teacher reflectivity in their own practices, and assists in supporting communities of practice. According to Turner (2010), action research has surfaced as a vital strategy for school improvements in the literature. Teacher leaders may look to other teachers within the school for answers or may seek more advanced solutions by consulting the academic community (Smeets & Ponte, 2009). Sherry and Gibson (2002) argued that teacher leader given the necessary support and training "were able to grow beyond their traditional roles" (p. 183). Turner (2010) acknowledged that some teacher leaders may not be adequately prepared to be immersed in the research literature and may need assistance at the collegiate level to incorporate action research into their classroom. Turner (2010) stated that in designing course work for teacher leaders, "The field of education is shifting. The stakes are high in classrooms, and an emphasis on accountability demands that students achieve at a higher level. The reflections and conversations I had with my students during these courses reinforced for me the importance of training practicing teachers to engage in research-based practice to help accomplish this goal" (p. 72). Action research can serve academic leaders as a tool for investigating solutions to problems faced in the classroom.

Riel and Becker (2008) argued that action research from teacher leaders may contribute to altering the traditional power structures within schools. Gilles, Wilson, and Elias (2010) investigated the use of action research and the partnership between an elementary school and nearby college. According to Gilles, Wilson, and Elias (2010), action research "opens communication among teachers and school faculty; it increases awareness and reflection of

issues that affect learning and professionalism" (p. 93). The results of their research showed an increase in communication among teachers. The research also showed an increase in reflection concerning teaching practices and experiences that resulted in increased professional growth. Action research can serve educators as a powerful tool for locating solutions to problems and serving as a conduit for ideas.

The Effect of Technology on Schools

Futurist Marc Prensky (2009) made the case that digital technology was reshaping our way of thinking and understanding the world around us. Digital technology was also restructuring and "digitally enhancing" organizations. Our children swim in the complex currents of a digital river of data. They need the use of technology in order to locate, analyze and share with others. Mills and Tincher (2002) reached the conclusion that "technology integration in classrooms is more about technology and learning than it is about technology" (p. 3). Technology can be used as a teaching tool with great effect (McLeod, 2011). Girod and Cavanaugh (2001) state, "A technology-rich learning environment allows unlimited avenues for inquiry" (p. 4). Technology has also become the medium through which businesses, government and academia conduct their affairs (Silva, 2009). Toomey (2005) noted,

> Many schools are now experimenting with new approaches to teaching and learning. They are doing so because they consider it a valuable way to encourage the development in young people of higher order thinking skills such as synthesizing, analyzing and evaluating, problem solving abilities, working in groups and other lifelong learning skills. They also recognize the relevance of these skills for life in the information economy. (p. 4)

Technology has become commonplace in the classroom (Jukes, McCain & Crockett, 2010; Silva, 2009; Ward, 2003). Lessons should not center on the tool but instead on the curriculum (Cuban, 2001; Rogers, 1999; Whitehead, Jensen & Boschee, 2003).

Teacher technology leadership is critical if 21st century digital tools are to be completely developed within classrooms (Anderson & Dexter, 2005; Dexter, 2011). Moyle and Webb (2006) pointed out that it takes administrative support to fully integrate educational technology into a school. In 2003, Schiller surveyed principals from Newcastle, Australia. The principals identified an awareness of the role of educational technology in schools and the need for students to be productive 21st century citizens. Administrators in their role as technology leaders serve as catalysts in promoting organizational direction and growth (Katyal, 2011; Luthra & Fochtman, 2011).

According to the National Mathematics Advisory Panel (2008), the overarching goal of leadership should involve the instilling of technology skills simultaneously with content instruction. According to Silva (2009), these 21st century skills include the ability to think independently, solve problems in a collaborative manner, and make decisions based on research data. Educational technology can be useful in teaching students to collaborate and communicate (Kerawalla, Minocha, Kirkup, & Conole, 2008; Klobas, 2006; McAfee, 2006; Silva, 2009). Silva (2009) stated that 21st century skills are what students can do with knowledge. These skills include the ability to locate the necessary knowledge to solve problems and then communicate the findings (Barton & Cummings, 2008; Perez, 2009).

Wozney, Venkatesh and Abrami (2006) noted that technology is a powerful tool for learning because it enhances the educational process and provides new strategies for teaching the technology-savvy student. Dwyer, Ringstaff and Sandholtz (1991) acknowledged that students

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are more actively engaged in classrooms where technology is successfully integrated. Dwyer, Ringstaff and Sandholtz (1991) also reported that the role of teachers in their study went from being "total dispensers of knowledge" to facilitators. As facilitators, the teacher's role becomes that of a guide who "compels students to want to learn" (Jukes, McCain & Crockett, 2010, p. 17). Technology integration into the classroom can cause a pedagogical shift to occur in the classroom (Dwyer, Ringstaff & Sandholtz, 1991). Teacher technology leadership is critical in shifting pedagogical practices towards student-centered activities (Sheingold & Hadley, 1990).

Educators are tasked with instilling in students 21st century skills such as the ability to locate, analyzes, and present information; and having the knowledge necessary to develop solutions to problems (McLeod, 2011). Teacher technology leadership is necessary in providing support, encouragement, and direction, which in turn may alter teacher beliefs and school culture (Dexter, 2011; Riel & Becker, 2008).

Teachers as Technology Leaders

Riel and Becker (2008) composed a framework based upon their research of the Teaching, Learning, and Computing National Survey (1998). From the survey data, the researchers discovered that with the introduction of technology into schools, 'a significant number" of teachers had become advocates for helping fellow teachers include technology in their instruction (Riel & Becker, 2008, p. 397). Riel and Becker (2008) proposed a framework for teacher technology leadership based upon four characteristics of teacher leadership:

Riel & Becker (2008)

- Teachers Learning with Technology
- Teachers Collaborating around Technology
- Teachers Networking in Technology-Active Communities
- Teacher Contributing to Knowledge About Educational Technology

Figure 9. Riel and Becker's (2008) Teacher Technology Leadership Practices

Teachers Learning with Technology

Teachers must be knowledgeable users of technology in order to lead fellow teachers and students in 21st century schools. Teachers learning with technology describe educators who are capable of changing their teaching practices to reflect the current trend in technology (Riel & Becker, 2008). Teacher technology leaders who stay on the cutting edge of innovative digital tools must be highly motivated technology users. Part of the motivation is reliant on a school culture that aligns with a shared vision for student success with technology. Riel and Becker (2008) described these teacher technology leaders as having an "adaptive stance" (p. 412). Teachers committed to integrating technology into the curriculum, are open to new ways of teaching and learning in their classroom and as professionals.

Teachers Collaborating Around Technology

Teachers collaborating around technology describe teacher technology leaders sharing classroom experiences and discoveries with other professionals. Riel and Becker (2008) argued teacher technology leaders who share, mentor, and coach with peers build "social capital" (p. 413) from their experiences and expertise. Riel and Becker (2008) describe this process as "help and talk" (p. 413). They argue that the assistance needs to come from the experiences of the teacher technology leader and be relevant to the situation. Riel and Becker (2008) report that

the expertise can be of a pedagogical or technical nature with regards to using technology. Teacher technology leaders who assist their peers can become contact points for future help and support. Teacher technology leaders will need to invest in social networks in the school and abroad in order to continue to successfully assist in a timely, relevant manner (Riel & Becker, 2008). Expertise in isolation may fail to produce a change in beliefs or school culture.

Teachers Networking in Technology-Active Communities

Riel and Becker (2008) describe teachers networking in technology-active communities as teacher technology leaders who participate with experts outside the school to solve problems. The Internet has proven to be a valuable avenue for teacher technology leaders to seek and assist others. Riel and Becker (2008) identified online communities and wikis as a means of disseminating teacher practices and effective strategies to others. Online communities such as GlobalSchoolNet (http://www.globalschoolnet.org) offer solutions and experiences from contributing teacher technology leaders to fellow educators worldwide.

Teachers Contributing to Knowledge about Technology

Teacher technology leadership involves educators who wish to add to the body of academic technology literature in order to affect change on schools at large. Teacher technology leaders can contribute their research and expertise through online sites such as Edutopia (http://www.edutopia.org) and Technology and Learning (http://www.techlearning.com). Teacher technology leaders who publish do so in the hopes of influencing teacher practices and current trends. Teacher technology leaders hoping to add to the best practices of classroom teacher can use action research as a means of investigating problems facing classroom teachers. Action research may also serve as a tool for publishing professional articles relevant to classroom educators.

Action Research

Teacher technology leaders may use action research as a means of seeking solutions to problems. Waldron and McKleskey (2010) suggest that schools seeking to reculture their beliefs and norms form a Comprehensive School Reform team (CSR). The CSR team can be composed of 8-20 teachers that represent various perspectives of the school. The first objective of the team is to examine all data on student achievement. Second the CSR teams should ascertain the school's resources available to meet student needs. Third the CSR team needs to meet with outside expert sources such as university professors to give advice and direction of meeting student needs. A plan is formulated and presented to the faculty seeking input and ownership. Professional development ensues that is aimed specifically at the problem areas identified in the data. Once adequate training has occurred, the plan is implemented. The CSR team is responsible for collecting feedback from the faculty and putting in place the necessary adjustments. Teacher technology leaders can use action research to solve problems in the classroom.

Action research may also be used as a means of altering the school's culture. Gilles, Wilson and Elias (2010) reported, "Action research emerged as one of the engines that drove renewal" (p. 92). Empowerment and meaningful reflection about beliefs and practices created an awareness that allowed teachers to "assume control over their respective situation" (p. 93). Teacher technology action researchers are needed in schools to immerse themselves in the literature and connect with others in search for viable options in integrating technology into the classroom.

Conclusion

Computerized technology has become intertwined in all aspects of our society. As a nation, we expect schools to shape our youth into technologically savvy workers who are prepared for the global stage (Cisco, 2008; Jukes, McCain, & Crockett, 2010; Marx, 2006; Silva 2009). The President for the Partnership for 21st Century Skills argued students need the ability "to think critically, solve problems, communicate, collaborate, use technology and be globally competent" (p. 22).

In order to meet the 21s century needs of students, some schools have initiated one-to-one laptop programs. Laptop Junior High School implemented a laptop initiative as a means of incorporating 21st century skills across the curriculum. The literature revealed that leadership is essential in supporting the integration of technology across the curriculum (Anderson & Dexter, 2005; Dexter, 2011; Katyal, 2010; Luthra & Fochtman, 2011; McPherson & Borthwick, 2011).

The need for technologically minded leadership is giving rise to teacher technology leaders from the educational ranks (Flanagan & Jacobsen, 2003; Gurr, 2004; McLeod & Richardson, 2011; Moyle & Webb, 2005). Margaret Riel and Henry Jay Becker (2008) described teacher technology leadership as those who "foster exemplary practice among other teachers" in the use of technology in the classroom (p. 398). Teacher technology leaders find themselves as agents of change that strive to communicate, model and support the integration and use of technology across the curriculum (Dexter, 2011; Flanagan & Jacobsen, 2003; Gao, Wong, Choy & Wu, 2010; Katyal, 2010; Luthra & Fochtman, 2011; McPherson & Borthwick, 2011). In turn, teacher technology leadership practices are altering school culture to embrace the technological change that is occurring in our society (Dexter, 2011; Dexter, Doering, & Riedel, 2006; Donnison, 2007; Katyal, 2010; McPherson & Borthwick, 2011; Riel & Becker, 2008).

CHAPTER 3: METHODOLOGY

Purpose of the Study

Technology is an integral part of our society (McLeod, 2011; Prensky, 2010; Silva,

2009). We expect schools to prepare students to be effective workers in the 21st Century

(Bell, 2010; Cisco, 2008; Jukes, McCain & Crockett, 2010; Liu, 2010; Pappas, 2009, p. 10).

A 2007 poll revealed that ninety-nine percent of participants believe that teaching 21st

century skills "is important to our country's future economic success"

(http://www.21stCenturySkills.org). Silva (2009) argued that students need 21st century

skills in order to be "independent thinkers, problem solvers, and decision makers" (p. 630).

The Partnership for 21st Century Skills (http://www.21stCenturySkills.org) proposed that 21st

Century skills should center on the following:

21st Century Skills

• Creativity and Innovation
• Critical Thinking and Problem Solving
• Communication and Collaboration
• Information Literacy
• Media Literacy
• Information, Communication and Technology (ICT) Literacy

Figure 10. 21st Century Skills (http://www.21stCenturySkills.org)

Schools need to incorporate 21st century skills holistically in order to prepare students to be productive citizens on global and virtual stages (Jukes, McCain & Crockett, 2010; Liu, 2010; McLeod, 2011; Pappas, 2009; Prensky, 2009, 2010).

Some schools have pursued a one-to-one laptop initiative as a means of preparing students for life in the 21st century (Garthwait & Weller, 2005; Goodwin, 2011; Keengwe, Schnellert & Mills, 2011; Penuel, 2006; Silvernail, 2011). Supporters of one-to-one laptop initiatives believe that technological practices embedded throughout the curriculum may give students the necessary experiences to be competitive in the workplace (Bebell & Kay, 2010; Donovan & Strudler, 2007; Weston & Bain, 2010). The Laptop School System (a pseudonym) launched a one-to-one laptop initiative in 2005 with the express goal of preparing students for life in the 21st Century. The President of the Laptop School Board stated, "Children must be prepared for a tech-savvy world" (Intel, 2008). Preparation for such a one-to-one laptop initiative begins with technologically savvy school leadership (Bonifaz & Zucker, 2004; Cisco, 2008; Intel, 2008; Penuel, 2006; Weber, 2009).

School leaders need to understand and demonstrate 21st century skills in order to bring laptop initiatives into schools. Many administrators are not prepared for the task (Anderson & Dexter, 2005; Dexter, 2011; Flanagan & Jacobsen, 2003; Schrum et al, 2011; Yuen, Lee & Law, 2009). Some administrators are cultivating leadership practices in others to create professional communities (Thornton, 2011). Dexter (2011) argued technology leadership might be randomly dispersed throughout the school and within the district. Lambert (2002) argued that schools would have to be led by more than just a single administrator. She suggested, "Leadership is the professional work of everyone in the school" (p. 37). Dexter (2011) concurs, "Successfully implementing a complex improvement effort warrants team-basis leadership" (p. 167). A

number of teachers are taking up the yoke of leadership through their embracement of technology (Riel & Becker, 2008). These teachers are moving beyond their traditional role in the classroom (Sherry & Gibson, 2002). Teacher technology leaders are helping administrators to change pedagogical practices by supporting other teachers in implementing 21st century tools across the curriculum (Dexter, 2011; Riel & Becker, 2008). I performed a case study of Laptop Junior High School in order to investigate the practices of teacher technology leaders as they help lead and support a one-to-one laptop initiative.

In 2005, a one-to-one laptop initiative was launched at Laptop Junior High School. The one-to-one laptop initiative was part of a system-wide vision to prepare all students for entry into a technologically advanced workforce. Research, planning, partnerships, support, and leadership have transformed the model school's culture into a 21st century student-centered laboratory (Intel, 2008) that embraces technology. Technology experts at the system and state level contend teacher technology leaders at Laptop Junior High School are helping to lead the use of technology throughout the school. I used the following frameworks as a lens through which I viewed my data: (a) administrative leadership practices researched by Diane L. Yee (2000); (b) NETS-A (2009) administrative technology leadership standards; (c) NETS-T (2008) technology standards for classroom teachers; and (d) the teacher technology leadership practices identified by Riel and Becker (2008). The standards and practices from these four frameworks guided the creation of my research:

- What is the nature of teacher technology leadership at Laptop Junior High School?
- How has the one-to-one laptop initiative changed teacher technology leadership practices?

- How do the practices of teacher technology leaders and administrators differ at my model school?

Research Strategy

My worldview is that of a social constructivist. I believe that as I live my life, I process new data, modify old ideas, learn new things, which constitute what I know (Schwandt, 2007). I believe human experiences are like threads, which when woven together form a complex tapestry. Such tapestries need to be examined in detail and as a whole in order to be understood (Senge, 1990). Complex human experiences should be researched in natural settings, in order to increase understanding of what is occurring in a holistic manner (Lincoln & Guba, 1985). My research began with on-campus interviews. Interviews allowed me to capture some of the excitement of teacher technology leaders acting as agents of change (Berg, 2009; Creswell, 2007; Kvale & Brinkman, 2009; Van Maanen, 1988). My visits to the Laptop Junior High School immersed me into the digital culture of the school. Their passion rekindled my own personal feelings towards the importance of technology in schools. My curiosity and passion about teacher technology leadership has placed me on this path to investigate the role of teacher technology leadership at Laptop Junior High School.

The recorded experiences of teacher technology leaders at Laptop Junior High School gave me insight into my own experiences leading technology. This coincides with Creswell's (2007) view that social constructivists seek to understand the world through both their experiences and others. Stake and Trumbull (1982) have labeled this awareness as naturalistic generalization. Stake (2000) argued, "We come to know what has happened partly in terms of what others reveal as their experience" (p. 442). Our understanding of the world comes from our own immersion with society (Creswell, 2007). We are able to generate questions and meaning

about life, through our interaction and experiences. Case study research lends itself to detailed analysis of an experience or subject (Creswell, 2007). My case study is an investigation into what teacher technology leadership looks like at Laptop Junior High School.

Research Design

As technology becomes more intertwined in all aspects of our world, we expect schools to adequately prepare students with the skills to locate and analyze data, communicate and collaborate with others in creating solutions to problems (Jukes, McCain & Crockett, 2010; Liu, 2010; McLeod, 2011; Silva, 2009). Some researchers believe that teacher technology leaders are helping to change school culture to meet the 21st century technological needs of students (Dexter, 2011; Katyal, 2010; Riel & Becker, 2008). Riel and Becker (2008) argued that teacher technology leaders could alter school culture by providing expert support and timely direction in meeting students' needs. Their influence can cause a change in the use of technology within the organization (Dexter, 2011, Jukes, McCain & Crockett, 2010, Katyal, 2010; McLeod, 2011; Sherry & Gibson, 2003; Ward, 2003). Teacher technology leadership practices may support the responsibilities of administrators in preparing students for the workforce of the 21st century (Dexter, 2011).

As a researcher, I am the key instrument of this project (Creswell, 2007). My research of teacher technology leadership practices includes 21 years of technology leadership in both secondary and elementary schools. I am also drawing upon my review of teacher technology leadership in the academic literature. Reading about the experiences of other educators leading technology has added clarity to my experiences and shaped my conceptual analyzes of the data and possible theory. I performed a case study of Laptop Junior High School in order to

investigate the practices of teacher technology leaders as they assist the administration in leading and supporting the one-to-one laptop initiative.

In this case study, I interviewed teacher technology leaders, administrators and other teachers who have received support from teacher technology leaders at Laptop Junior High School. The administrative frameworks of Yee, (2000) and NETS-A, (2009) served as a lens for viewing my data. I also used the frameworks of Riel and Becker (2008) and NETS-T (2008) as a lens for my data. I viewed my data through these four frameworks, to assist in understanding my data of what teacher technology leadership looks like at Laptop Junior High School. I also wanted to differentiate the practices of administrative and teacher technology leadership at my model school.

The Model School

I wanted to locate a model school where teacher technology leadership was in evidence. In order to locate the model school I consulted two experts who were networked with system technology coordinators and school leaders across the state. My first source was Berry (a pseudonym) who works in the Technology Initiatives Office at the State Department of Education. He serves as coordinator for the state virtual library and library media programs. Berry also coordinates the Enhancing Education Through Technology (EETT) Title II, Part D grant funding. I have worked with Berry for the past two years as a grant reader for the EETT funding. I chose Berry because he serves as a barometer regarding technology leadership across the state.

I contacted Berry and presented him with the frameworks provided by Riel and Becker (2008) and NETS-T (2008) of what a teacher technology leader might look like. I gave examples of teacher leaders who (a) are flexible in their instructional practices; (b) collaborate

with other local educators regularly; (c) network with professionals on a regional and global scale through conferences, emails, wikis and blogs; (d) transmit their leadership experiences and findings to help build knowledge in the academic community (Riel & Becker, 2008). I conveyed an interest in researching a model school where I could observe teacher technology leadership practices. He immediately recommended two schools within the state and provided the necessary contact information. Berry then proceeded to give detailed examples of technology usage and the role of teachers in leading the technology in both schools to defend his selections.

Next I consulted my system technology coordinator concerning schools about which he had first-hand knowledge of teacher technology leadership. Hugh (a pseudonym) has served as both a junior high math teacher and now a system technology coordinator for almost fifteen years. As a system technology coordinator for a 6A school system, he was part of a network of technology leaders across the state. Hugh was keenly aware through direct observations, statewide meetings, and technology conferences of the schools that are on the vanguard of technology within the state. I met with Hugh and presented him with the four frameworks. I provided him with the same specific examples of teacher technology leadership that I provided to Berry. He immediately identified the same two schools that Berry had identified. I phoned the district technology coordinators in both school systems.

The first system technology coordinator was hesitant to agree with my request because of lack of time due to the piloting of iPads throughout the system. I contacted the Laptop district technology coordinator and she agreed immediately to my request. She informed me that I would have to seek permission with the superintendent's office before beginning my research (see Appendix 1). After gaining approval with the board of education office, I spoke with the school's new principal over the phone and arranged a meeting.

The Participants

      I met with the principal in order to introduce myself, deliver consent letters and to describe my research. My description included my three guiding research questions and an overview of the teacher technology leadership practices identified by both Riel and Becker (2008) and NETS-T (2008). I described teacher technology leaders who (a) are flexible in their instructional practices; (b) collaborate with other educators; (c) network with professionals and; (d) contribute to the research literature (Riel & Becker, 2008). The principal met with the assistant principal and the district technology coordinator to create a list of teacher technology leaders as potential participants. By allowing the administrators to create a list of potential participants, I used purposeful strategy (Schwandt, 2007) in my sampling because teacher technology leaders are relevant to my research. I also used the meeting to ask the principal some questions and gain a first impression of the school's technology culture. She emailed me a list of potential interviewees who were willing to participate. My recruitment of participants was dependent upon the practices and standards I identified in my initial meeting with the principal (Arcury & Quandt, 1999; Kelly, 2010). All potential interviewees agreed to participate. The principal created a schedule for conducting the interviews so it would coincide with teacher planning times. Table 1 identifies the participants in my study.

Table 1

Participant Backgrounds

Teacher Technology Leaders	Years of Experience	Background
Cincinnatus (Social Studies/ Teacher Technology Leader)	10	Strongly influenced to become a teacher by personal efforts of college professor.
Curie (Science/Teacher Technology Leader)	7	Father served in the military. Moved a lot during childhood. Headed toward a career in medical school and discovered a desire to teach/
Linus (Information Technology Coach)	14	Spent 4 years teaching physical science at the junior high level. Taught high school physics for 4 years. Worked last six years as IT Coach. Works to assist teachers in integrating technology into instruction. Provides timely guidance and training.
Titania (English/Teacher Technology Leader)	16	Has taught grades 7th-college. Started out with a chemistry background and made the decision to become a teacher of French and English.
Archimedes (Math/Teacher Technology Leader)	26	Father and grandfather were as math teachers. Serves as an adjunct professor at a nearby college teaching math to first year engineering students. Loves amateur astronomy, martial arts and gardening. Extremely dynamic personality.
Emmy (Math/Teacher Technology Leader)	8	Mother of two children, has served all eight years at Laptop Junior High School. Member of the steering committee who visited schools in Virginia and Texas performing research on the one-to-one laptop initiative.
Alcibiades (History/Teacher Technology Leader)		Part of the Persistent Issues in History Network. Works closely with nearby university professor to deliver history lessons that align with current events.

(table continues)

Table 1 (continued

Teacher Technology Leaders	Years of Experience	Background
Beneficiaries of Teacher Technology Leaders		
Roosevelt (History)	4	Motivated new teacher who is learning a lot about the technological culture of the school from H1/TTL.
Administrators		
Hypatia (Assistant Principal)	25	Last nine years of work experience has occurred at Laptop Junior High School. Taught all grades: 1–12 including enrichment and special education students.
Ada (District Technology Coordinator)	11	Background in business with a Master's degree in education. Doctoral student in education leadership. One of the 3 administrators who assembled a steering committee to research the laptop initiative.

Data Collection

Interviews are a means to produce knowledge (Kvale & Brinkmann, 2009). I used a

semi-structured format because it afforded me flexibility in generating deep discussion (Kvale &

Brinkmann, 2009). I used the following questions as a foundation for the interviews:

- What is the role of the administrator in regards to technology?

- What are some examples of technology being used in your classroom to teach 21st

  century skills?

- What is your role as a classroom teacher in regards to technology?

- Your principal or system technology coordinator has identified you as a leader in the

  use of technology in the school. How do you lead?

- Describe some of your experiences in working with others to integrate and use technology.

I began my data collection by interviewing 10 teacher technology leaders. A private room was arranged so that the conversations could occur in a quiet area of the building. The meetings occurred during the teacher's planning period. Each potential participant was given a consent form (see Appendix 2) and was made aware of their rights to withdraw from the interview at any point.

My participants included only the teacher technology leaders that had been identified by the principal and had volunteered for the interviews. Each interview lasted between 35 and 50 minutes. I arranged follow-up interviews and emails with teachers I identified in the interview data as beneficiaries of the leadership practices of fellow teachers. I also interviewed the system technology coordinator as part of my follow-up interviews. I saved the system technology coordinator for the follow-up interviews because I wanted to refine some of the questions asked based on the data from the initial round of interviews. I used her interview as a means of triangulating the data introduced in the teacher technology leader interviews. I included the school's technology plan, school improvement plans, and the school's website as part of my data. Each interview concluded with a debriefing process (Kvale & Brinkmann, 2009). The debriefing process gave each participant an opportunity to ask questions. I used a professional transcription service to transcribe my interview data into Word documents. I checked the transcriptions for accuracy.

Data Analysis

The frameworks proposed by Diane L. Yee (2000) and NETS-A (ISTE, 2009) identified characteristics of administrators who lead the integration of technology in schools. Yee (2000)

gathered thick descriptions of administrators using information and communication technology (ICT) in schools in the United States, Canada, and New Zealand. Her study examined the ICT support administrators provided staff members. She identified eight practices that arose from interview data with administrators in schools.

I also explored the five standards identified by National Educational Technology Standards (NETS-A) for administrators (ISTE, 2009) regarding the role of administrators leading the use of technology in schools. Descriptions of each standard are provided on the website (http://www.iste.org/standards/). The International Society for Technology in Education (ISTE) serves as a source of advocacy and professional development in technology leadership. The standards overlap with the Yee (2000) framework.

Yee (2000)

• Equitable providing • Learning-focused envisioning • Adventurous learning • Patient teaching • Protective enabling • Constant monitoring • Entrepreneurial networking • Careful challenging

Figure 11. Yee's (2000) Administrative Technology Practices

NETS – A (2009) standards for administrative leadership of technology in schools.

NETS-A (2009)

- Visionary Leadership
- Digital Age Learning Culture
- Excellence in Professional Practice
- Systematic Improvement
- Digital Citizenship

Figure 12. National Educational Technology Standards for Administrators (2009)

I chose these two frameworks as guides for identifying the practices and standards of administrative technology leaders. These a priori codes served as a lens through which I passed my data. I passed the data through these two frameworks in case teacher technology leaders at Laptop Junior High School also exhibited administrative leadership practices identified by Yee (2000) and NETS-A (2009). These two groups of standards gave focus to my crafting of research questions for interviews and provided a lens through which I viewed my interview data. I incorporated these administrative practices and standards in order to investigate whether these practices and standards were visible in teacher technology leaders at Laptop Junior High School. Riel and Becker (2008) reported on the different levels of professional engagement from the Teaching, Learning, and Computing National Survey. Their findings illuminated five sets of practices for teachers who are strong advocates for technology usage (Riel & Becker, 2008). My case study of teacher technology leadership is an extension of Riel and Becker's (2008) research.

National Educational Technology Standards (NETS-T) for teachers (ISTE, 2008) provides a framework of five standards for integrating and using technology in the classroom to improve student learning. The five standards are described in detail on the website (http://www.iste.org/standards/). These two frameworks served to guide my creation of

interview questions for teacher technology leaders in the model school. I also passed my

interview data through these two frameworks in order to add to the theory of Riel and Becker's

(2008) study of teacher technology leaders.

Riel and Becker (2008)

• Teachers Learning with Technology • Teachers Collaborating around Technology • Teachers Networking in Technology-Active Communities • Teacher Contributing to Knowledge About Educational Technology

Figure 13. Riel & Becker's (2008) Teacher Technology Leadership Practices

NETS-T (2008)

• Facilitate and Inspire Student Learning and Creativity • Design and Develop Digital-Age Learning Experiences • Model Digital-Age Work and Learning • Promote and Model Digital Citizenship and Responsibility • Engage in Professional Growth and Leadership

Figure 14. National Educational Technology Standards for Teachers (2008)

I used Atlas.ti to analyze the data. Miles and Huberman (1994) list Atlas.ti as a "code-

and-retrieve program" (p. 312). Atlas.ti has many functions, which can assist the researcher

when dealing with large amounts of data. The software allows the import of a variety of file

types. Atlas.ti presents the researcher with a user-friendly means coding of text. The software

allows for multilevel and overlapping coding which was helpful in my research because I was

using two different sets of a priori codes. The software also offers both memoing and note

taking tools that are critical to analysis. Finally, Atlas.ti has a strong search engine for locating

quotes, words, or codes and sorting.

My case study investigated whether the practices and standards of the four frameworks are present at my model school, and to report any new practices so as to extend theory. Yin (1994) argues that theory can arise from the literature before coding. I agreed with Yin (1994) and formulated my a priori codes from the literature. Coding is the analysis of the data (Miles & Hubermann, 1994). Key words or phrases appear in the data, and these phrases are assigned a code. According to George Allan (2003) coding is a means to "conceptualize the underlying issues." I used memos while coding, to take snapshots of emerging thoughts and theories while analyzing data. Memos are a way of recording thoughts and theories and conceptualizing the data through the use of digital sticky notes. Atlas.ti allows for the creation, sorting and searching of memos.

Identifying a subject or problem requires experience or a review of the literature in order to bring focus to what is being researched and guide the research questions. I have likened my research to that of a miner sluicing for gold. I start the process by looking for any large, noticeable nuggets (open coding/In-Vivo codes) in the dirt and follow up by washing the detritus (data) through the multilayered sluice (a priori codes generated from the literature review) in search of finer grains of gold (emergent codes/additions to theory) (Charmaz, 2000; Creswell, 2007; Strauss & Corbin, 1990). I concluded my analysis by having other miners (peer reviewers) weigh the value of my finds against their own interpretation of the data (Miles & Hubermann, 1994). Peer reviewing serves to assist the researcher by providing fresh eyes on the data.
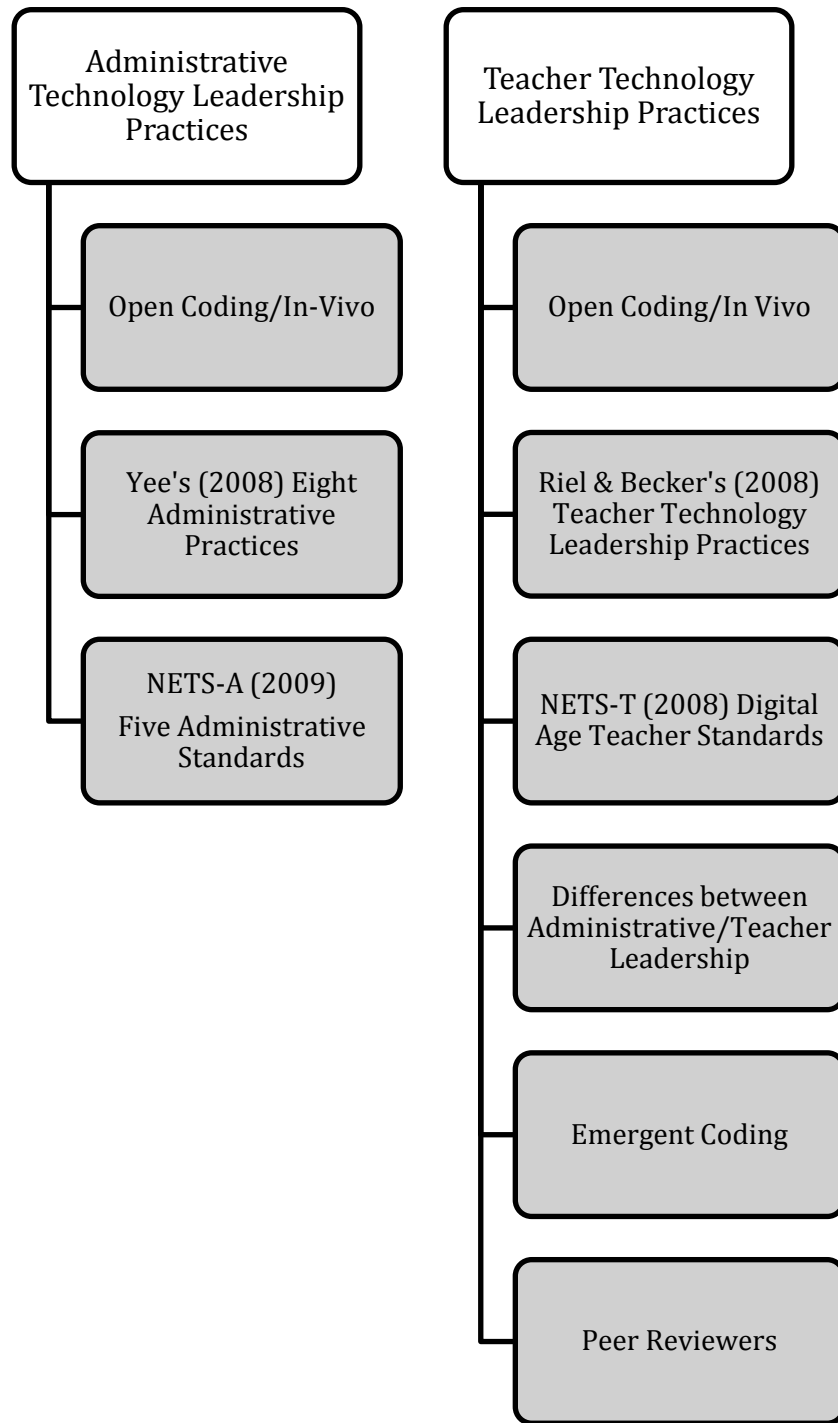
Figure 15. Analyzing the Data

Open Coding/ In Vivo

I followed the advice of Glazer and Strauss (1967) and started the analysis process by conceptualizing the data using open coding. Glaser and Strauss (1967) recommend starting the analysis without any preconceived notions. I felt that the initial examination of the interview data was the most critical because I wanted to observe the material for the first time with fresh eyes, looking for terms or phrases that appeared regularly or stood out in the data (Strauss & Corbin, 1990). It was difficult for me to distance myself from the a priori codes identified in my four frameworks. I decided that the best course I could take would be to simply code using the first impression that came to mind. I knew that some of my open codes would clearly overlap with the a priori codes. My goal with the open coding was the search for practices that did not fall under an a priori code. As I performed my open coding I created numerous memos of my initial impressions of what I thought the interviewee was describing. Any terms or phrases that seemed a good fit for the description were incorporated as In-Vivo codes.

a Priori Coding

My second pass of the data involved the eight leadership practices of Yee (2000) as a priori codes. I reread Yee's dissertation to gain a fresh understanding of her thick descriptions of each of the standards her participants identified. My third pass of the data used five administrative standards identified by NETS-A (ISTE, 2009) as a priori codes. Memoing was used in examining the data through Yee's and the NETS-A frameworks. The NETS-A framework has descriptions that explain each item (ISTE, 2009). I reread these descriptions before examining the interview data. My fourth pass of the data involved five teacher technology leadership traits as a priori codes (Riel & Becker, 2008). Riel and Becker (2008) gave examples and findings of other researchers concerning each dimension of their framework. The fifth pass

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of the interview data involved NETS-T (ISTE, 2008) teacher standards as a priori codes. NETS-T (2008) provided examples for each of their standards. Memoing was used to examine the data through both the Riel and Becker (2008) framework and the NETS-T (2008) frameworks.

Emergent Coding

My sixth pass of the interview data was spent looking for emergent codes that did not directly fall into any of the four frameworks. The final analysis of the data included interpreting the memos produced throughout the previous six passes of the data. It was from the emergent coding that I looked to extend the research of Riel and Becker (2008).

Trustworthiness

Trustworthiness is the term Lincoln and Guba (2007) used to describe a set of criteria that act as quality control for qualitative research. Trustworthiness rests on a foundation of:

1. Credibility
2. Transferability
3. Dependability
4. Confirmability

Credibility

Credibility is my assurance that what I have reported in the case study coincides with what the participants meant (Creswell & Miller, 2000; Lincoln & Guba, 1985). I conducted interviews, follow-up conversations, and observations for a period of three months. The initial interviews took between 35 and 50 minutes and occurred during the teacher's instructional planning time. Follow-up discussions occurred through emails and follow-up observations.

To add credibility to my research I also used triangulation to examine the data "from more than one vantage point" (Schwandt, 2007, p. 278). My interview with the district technology coordinator served as a means of checking data from other sources (Creswell & Miller, 2000). I used articles written about Laptop Junior High School's one-to-one laptop initiative, the school and district technology plan's and teacher school web sites as additional sources of triangulation with the interview data.

Peer Reviewing

Peer reviewing is a tool to assist in checking "the credibility of our data and minimize the distorting effect of personal bias upon the logic of evidence (Lather, 1986). I chose two of my doctoral cohorts members to review my analysis (Miles & Hubermann, 1994). Since I am examining teacher technology leadership practices I decided to choose two classroom educators. I believe that both are very insightful of current technological trends, and serve as teacher leaders within their schools. My reasoning for identifying them as teacher leaders is due to their current academic pursuits of educational leadership at the doctoral level. Both have received training as qualitative researchers. My goals for the peer review included verification of coding and interpretations of findings from analysis of the emergent codes (Creswell & Miller, 2000; Lincoln & Guba, 1985; Schwandt, 2007). Table 2 identifies their areas of responsibilities.

Table 2

Peer Reviewer Verification Table

Peer Reviewer X	Peer Reviewer Y
Perform their own open coding of data	Perform their own open coding of data
Check coding of a priori codes from Yee (2000) and NETS-A (2009)	Check coding of a priori codes from NETS-T (2008) and Riel and Becker (2008)
Check emergent codes	Check emergent codes

I met with the Peer reviewers twice using Skype (http://www.skype.com). Skype software offers users the ability to perform group video calling. I worked to arrange convenient meeting times through email. Files were exchanged via Dropbox (http://www.dropbox.com). Dropbox is a cloud-based file sharing service. I shared my codebook, dissertation, and Atlas.ti coding data. The codebook (see Appendix 5) contains the codes, definitions, and exemplary data. The codebook "provides a stable frame for the dynamic analysis" of examing the data (MacQueen, McLellan, Kay & Milstein, 1998, p. 1). I also asked my peer reviewers to join my online reflexive journal. During the initial meeting I discussed with them their roles as peer reviewers and set a tentative date to meet again. The peer reviewers noted any discrepancies or recommended addition to the codebook. They were asked to address any biases they felt towards the subject matter and data. They also presented their overall impressions of my coding of the material with emphasis on the open and emergent codes. My peer reviewers served to "de-center me as the singular voice of authority" (Poirier, 2009, p. 99) and added to the trustworthiness of my research (Lincoln & Guba, 1985).

Transferability

Transferability or generalization allows the reader to delve into the research and possibly extract data that may lend clarity to the reader's personal experiences with the subject matter (Stake, 1995). Geertz (1973) argues that I should provide thick descriptions in order to produce research that may be transferable to others. Thick descriptions should bring the participant experiences to life. Researchers who read my thick descriptions should feel as though they have met these teacher technology leaders in action supporting fellow teachers (Creswell & Miller, 2000). Thick descriptions are essential in providing enough data to devise and extend theory Geertz (1973).

Dependability and Confirmability

An audit trail is the documentation surrounding the development and execution of my research (Lincoln & Guba, 1985). Dependability relies on the depth and transparency of the audit trail, so that future researchers can judge and reconstruct the case study (Lincoln & Guba, 1985; Miles & Huberman, 1994). I used Google Calendar (https://www.google.com/calendar/) as part of my audit trail because it is web-based and embeddable into my reflexive journal. I maintained a reflexive journal as a means of confirming dependability (Creswell, 2007). My reflexive journal is a tool for exploring and self-critiquing my experiences, thoughts and bias (Creswell, 2007). Lather (1986) argued that reflexivity is key in determining the trustworthiness of the research. I chose to use a wiki (Cole, 2008) as my reflexive journal because it provides an interactive medium through which I can:

- Customize data and information

- Knowledge sharing

- Collaborate

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I chose to use Wikispaces (http://www.wikispaces.com/) because it provided an easy-to-use web-based platform at no cost. The wiki is customizable through a variety of templates. My wiki serves as my reflexive journal to capture impressions, ideas, and theories of the data collected. It provides insight into my thought process during the research (Blaschke & Brindley, 2011). The wiki also serves as a means of confirmability through transparency, if future researchers wish to follow the path of my research. The wiki lends itself as a searchable and shareable tool that keeps with the technological nature of my research (Bruns & Humphreys, 2005).

Limitations of Study

Generalizability is the degree to which you can transfer research findings to other situations (Kvale & Brinkman, 2009). Maxwell (1992) suggested that generalizing qualitative findings is analogous to gaining an understanding of the situation and using that understanding to help make sense of similar situations. This is what Stake (2000) terms as naturalistic generalization. Expectations may be derived from the findings. My research centers on the practices of teachers who are helping to lead a one-to-one laptop initiative. The technology currently in place, the people and the school's culture are unique. The findings of this research may not be directly transferable or have external generalizability (Maxwell, 1992) to other situations.

The principal of Laptop Junior High School served as my gateway to participants. She was central in formulating a list of potential participants and creating a schedule that would not conflict with instructional times. The principal started her position in the fall of 2011. Her experience of the faculty was limited. She had to rely on the district technology coordinator and assistant principal to assist in creating a list of potential participants. A principal who had been

with the organization through the inception of the one-to-one initiative in 2005 may have had greater insight into teacher technology leadership practices.

Significance of Study

I believe that teachers who are adapting to the Digital Age may find themselves at the intersection of leadership and technology integration (Dexter, 2011; Liu, 2010; Prensky, 2010; Yuen, Lee & Law, 2009). Some teachers are moving beyond their own classrooms to assist other educators by providing technology support and direction. The integration of technology may serve these teacher technology leaders as a conduit for organizational change. These teacher technology leaders are assisting administrators in transitioning school culture to embrace technologically enhanced learning across the curriculum. My research of Laptop Junior High School was guided by my research questions:

1. What is the nature of teacher technology leadership at Laptop Junior High School?

2. How has the one-to-one laptop initiative changed teacher technology leadership practices?

3. How do the practices of teacher technology leaders and administrators differ at my model school?

I collected data in the form of interviews from a model school where a one-to-one laptop initiative had been implemented. The data collected was analyzed using open coding, four different sets of a priori codes from the literature, and a search for emergent codes. An audit trail was used to mark progression of my research. I used a wiki as a reflexive journal in order to facilitate thinking during my analysis of the model school (Bruns & Humphreys, 2005) and to

add transparency to my research (Creswell, 2007). Peer reviewers were used to judge my

analysis and added their voices to my interpretations.

CHAPTER 4: FINDINGS

Purpose of the Study

Technology has become an integral part of our society and the world in general

(Lieberman & Mace, 2010). From Facebook to iPads technology has filtered into many aspects

of our lives (Mcleod, 2011; Prensky, 2009, 2010). Jukes, McCain and Crockett (2010) argued

that technology represents a means to individualize education to meet children's needs.

Technology also presents a way for learning to occur both in real and virtual environments.

Silva (2009) argued that students need problem-solving skills to be independent thinkers in a

high-tech world. The Partnership for 21st Century Skills identified information literacy,

communication, collaboration, and creativity as some of the requirements facing young people

entering a global work force (see http://www.21stCenturySkills.org). Schools are charged with

the task of preparing students with 21st century skills (Jukes, McCain, & Crockett, 2010;

Lieberman & Mace, 2010; Liu, 2010; Mcleod, 2011; Pappas, 2009; Prensky, 2009, 2010).

Some schools have implemented one-to-one laptop initiatives as a means of preparing

students to be competitive in a digital work environment (Cisco, 2008; Intel, 2008, Lee & Zhao,

2008; Weber, 2009). One-to-one laptop initiatives have become more accessible because of the

drop in cost, increase in processing power of computers, and the improvement of wireless

capabilities (Penuel, 2006). Starting in 1999, the Governor of Maine, Angus King, assembled a

task force to devise a plan for meeting the educational technology needs of students because they

must be prepared to enter a technologically enhanced workplace. The task force argued:

We live in a world that is increasingly complex and where change is increasingly

rampant. Driving much of this complexity and change are new concepts and a new

economy based on powerful, ubiquitous computer technology linked to the Internet. Our

schools are challenged to prepare young people to navigate and prosper in this world,

with technology as an ally rather than an obstacle. The challenge is familiar, but the

imperative is new: we must prepare young people to thrive in a world that doesn't exist

yet, to grapple with problems and construct new knowledge which is barely visible to us

today. It is no longer adequate to prepare some of our young people to high levels of

learning and technological literacy; we must prepare all for the demands of a world in

which workers and citizens will be required to use and create knowledge, and embrace

technology as a powerful tool to do so. (Silvernail, 2011, p. 3)

Starting in 2001, Maine implemented a statewide one-to-one laptop initiative and

provided all seventh graders with laptop computers. The following year all eighth grade students

in the state were assigned laptops (Penuel, 2006; Silvernail, 2011). From data collected in a

survey, Maine educators concluded that students were making headway in "bridging the digital

divide" (p. 28, Weber, 2009). Silvernail and Gritter (2007) reported that after a decade, Maine

was still setting the example by providing laptop computers and wireless access to students

throughout the state. Numerous schools systems in other states have imitated the Maine

example.

In 2005 Laptop School District implemented a one-to-one laptop initiative as a means of

providing students with needed technology expertise across the curriculum (Bebell & Kay, 2010;

Donovan & Strudler, 2007; Weston & Bain, 2010). The foundation for the laptop initiative

started with leadership (Anderson & Dexter, 2005; Dexter, 2011; Katyal, 2010; McPherson &

Borthwick, 2011; Prensky, 2007; Riel & Becker, 2008). Technologically savvy leadership was necessary in order to integrate 21st century skills across the curriculum (Dexter, 2011; Schrum et al., 2011). Many administrators were not capable of leading the integration of technology (Anderson & Dexter, 2005; Dexter, 2011; Schrum et al., 2011; Yuen, Lee, & Law, 2009). Yet it was school administrators' responsibility to provide technology leadership.

In some schools, teachers have arisen from classrooms to assist administrators in leading the integration, usage and support of technology throughout the school (Riel & Becker, 2008). These "informal leaders" (Flanagan & Jacobsen, 2003, p. 127) have taken an active hand in leading the cultural changes associated with the integration of technology. These teacher technology leaders are providing support and direction in the integration of technology throughout the curriculum. Riel and Becker (2008) argued that a "distributed expertise of teacher leadership" (p. 415) was needed when integrating technology. My research addressed their conclusion. The purpose of my case study was to investigate what teacher technology leadership looks like at Laptop Junior High School. I interviewed 7 teacher technology leaders, a new teacher who received support from the teacher technology leaders, and 2 administrators.

My investigation was guided by these questions:

1.   What is the nature of teacher technology leadership at Laptop Junior High School?

2.   How has the one-to-one laptop initiative changed teacher technology leadership practices?

3.   How do the practices of teacher technology leaders and administrators differ at my model school?

I derived guiding questions from my experiences and the four frameworks that served as a lens for viewing my data. The NETS-A (2009) and Yee (2000) frameworks served as a priori codes for administrative technology leadership data. The NETS-T (2008) and Riel and Becker (2008) frameworks served as a priori codes for teachers who assist in leading the use of technology throughout the school.

I began my research of teacher technology leadership by investigating administrative technology leadership practices at Laptop Junior High School. Diane L. Yee (2000) performed qualitative research of exemplary principals in Canada, New Zealand, and the United States. These principals led schools where technology had been integrated throughout the school. These school leaders were designated as technology leaders by partner higher education institutions. Yee's (2000) thick descriptions uncovered eight practices that support the integration and use of technology in schools. These eight practices are:

- Equitable providing – Locate adequate technological resources and provide timely support and professional development.

- Learning-focused envisioning – The administrator is the keeper of the school's vision and serves as a model to assist in shaping teachers' beliefs.

- Adventurous learning – The administrator strives to master and share technological skills with others.

- Patient teaching – The administrator is keen to teach others about technological tools in the classroom.

- Protective enabling – The administrator creates leadership opportunities for teachers and students with regards to technology.

- Constant monitoring – The administrator ensures that instruction is in line with the vision and goals of the school.

- Entrepreneurial networking – The administrator works to form partnerships within the community in order to support the use of technology throughout the educational process.

- Careful challenging – The administrator serves as a risk taker and experimenter in meeting students' and teachers' needs.

I also used the five standards for administrative technology leadership (NETS-A, 2009) identified by the International Society for Technology in Education (ISTE):

- Visionary Leadership – The administrator leads the shared vision for technology usage throughout the curriculum.

- Digital Age Learning Culture – The administrator creates and promotes a technologically enhanced culture that supports the learning needs of 21st century students.

- Excellence in Professional Practice – The administrator strives to promote a professional environment that supports the use of digital resources in the classroom.

- Systematic Improvement – The administrator provides constant monitoring to move the integration and use of technology forward in the classroom.

- Digital Citizenship – The administrator serves as a model to promote responsible practices in the use of technology.

Between 1979 and 2011, this organization, composed of more than 100,000 educators and leaders, endeavored to promote the use and leadership of technology in schools in order to prepare students for a technologically oriented workforce. Both the research of Yee (2000) and

the NETS-A (2009) standards were used as lens through which to view my interview data for administrators who are technology leaders.

Riel and Becker (2008) believed that teacher technology leaders could influence teacher practices and assist in moving a school's culture toward embracing technology throughout the curriculum. Altering a school's culture to be more in tune with technological trends can help in providing instruction that is necessary to meeting the 21st century needs of students (Dexter, 2011; Katyal, 2010; Riel & Becker, 2008). I used the research of Riel and Becker (2008) as a lens through which to pass my teacher technology leadership data. Riel and Becker (2008) identified four standards in their research of teachers who led the integration and use of technology in schools:

- Teachers Learning with Technology – Teachers whose pedagogical practices are adaptable to current trends in technology.

- Teachers Collaborating around Technology – Teachers who share their classroom experiences and resources with others.

- Teachers Networking in Technology-Active Communities – Teachers who seek expertise outside the school in locating resources and searching for solutions to problems.

- Teacher Contributing to Knowledge About Educational Technology – Teachers who add to the body of academic technology literature to assist schools at large and influence teacher practices.

Finally, I grounded my research of teacher technology leadership in the National Educational Technology Standards (NETS-T) for educators led by Don Knezek and ISTE

(2009). ISTE (2009) argued educators need to align their classroom instruction with the

following standards in order to adequately prepare students for life in the 21st century:

- Facilitate and Inspire Student Learning and Creativity

- Design and Develop Digital-Age Learning Experiences

- Model Digital-Age Work and Learning

- Promote and Model Digital Citizenship and Responsibility

- Engage in Professional Growth and Leadership

These four frameworks served as a lens for viewing my data and assisted in interpreting my

findings.

Findings

Research Question 1: What is the Nature of Teacher Technology Leadership at Laptop Junior High School?

In answering my research questions, my interview data suggested teacher technology

leaders at Laptop Junior High School used the one-to-one laptop initiative as a conduit to change

pedagogical practices and school culture so that student needs were met. From the research of

Intel (2008a; 2008b; 2008c) conducted at Laptop Junior High School and my interviews of Ada

and Hypatia, I inferred that administrators were providing the overarching leadership practices

identified by Yee (2000) and NETS-A (2009) to lead Laptop Junior High School forward with

the one-to-one laptop program. The interview data suggested that teacher technology leaders

arose in both formal (professional development activities) and informal capacities (impromptu

meetings in the hallway or classroom). These teacher technology leaders reported to me that

they quietly assisted each other and their colleagues with timely support. They also reported

participating in action research and providing input into the direction of technology integration

on campus. All seven of the teacher technology leaders and Roosevelt identified each other as being recipients of timely support from other teacher technology leaders within the school.

Of the seven of the teacher technology leaders, Hypatia, and Ada discussed the role of technology throughout the school and the changes that have occurred in delivering instruction since the one-to-one initiative commenced. Archimedes spoke to me of the way technology has changed practices in his classroom:

> A couple of days ago, we had a math horizontal planning over in the room right next door over the data room. I had my students over here working an assignment and I had my DyKnow session up over in that room over there and they working on a different assignment over here with the substitute. They didn't have to go across the hall and I didn't have to come back over here. If they wanted to ask me a question, all they had to do is just open up the chat. They could ask me a question right here. I could see the problem that they were working on. I could respond back to the entire class even from a distance over there.

The access to laptops and the DyKnow software provided these teachers with a platform for delivering instruction while modeling and incorporating 21st century skills into the lesson. I also uncovered that teachers such as Archimedes were considered technology leaders by their peers at Laptop Junior High School. Each of the teacher technology leaders displayed mastery of their subject matter through the interview data and website materials. Each teacher was passionate about teaching and shared a vision for the importance of technology in the classroom. The interview data revealed a willingness and flexibility in each teacher technology leader to assist others in the educational process. The laptop initiative provided the medium that has allowed their leadership practices to flourish. One of the participants reported, "Sometimes a faculty

member who has expertise or interest in a certain area leads the professional development. In some cases it is led by Linus our technology coach, or by an outside person who's been selected to come in."

These teacher technology leaders are communicating their technology experiences with other faculty members through both impromptu and formal meetings. I concluded that horizontal planning and continuous professional development served as a medium for transmitting successful technology experiences among the faculty. Archimedes summed up the impromptu assistance that can occur:

> Linus will hear me talking about something just cross the hallway and he'll pop in the room. He'll stand at the doorway and listen for a second and then he'll say, "You know what else" – and then he'll just – it's almost like its collaborative teaching opportunity.

The interview data suggested that teacher technology leaders regularly spoke together during planning or in passing in the hall in order to share discoveries or ask questions from their surrounding neighbors. During and between my interviews, I observed several of the teacher technology leaders moving from one classroom to the next or speaking with other teachers in the hallway. I believe that these informal timely support experiences were a rapid means of finding solutions without scheduling formal professional development activities. I theorized from the interview data and my written impressions on the day of the interviews that there is a cadre of "digital disciples" that other teachers have approached with technological needs. I concluded that these informal support opportunities have altered the school's culture.

Riel and Becker (2008) identified teachers collaborating around technology as a social process involving those who have acquired expertise and educators who are in need of expertise. The researchers argued that many teachers felt pushed to integrate technology through

administrative expectations. Riel and Becker (2008) also noted in their research of teacher

technology leadership that the amount of digital tools available could make teachers feel

overwhelmed when integrating technology. Because of the wealth of tools available to the

faculty at Laptop Junior High School, I strongly suspected that all the resources available could

easily disorient new faculty members. Roosevelt confirmed my thoughts when he stated that "if

not for the help of Alcibiades he would be lost." Roosevelt showed me several of the digital

DyKnow lessons Alcibiades had shared and pointed out how he had used them as a template for

creating new lessons. Emmy described her leadership in sharing technological expertise and

resources with a new faculty member: "I was able to share with her the necessary lessons in

DyKnow format to get her started without her being overwhelmed by all the different software

we have available." Riel and Becker (2008) argued teacher technology leaders could build social

capital by assisting their peers through collaboration. I believe this group of teacher technology

leaders have amassed a wealth of social capital and have become a vital part of the school's

culture. Intel sent researchers to the campus in 2008 to investigate the one-to-one laptop

initiative. Many of the seven teacher technology leaders interviewed for this case study were

featured in the three part report because of their prowess with technology and the changes they

have helped to render within the school. This informal layer of expertise and leadership

provided timely support that helped to answer teacher's questions as they arise. These teacher

technology leaders kept a check on the professional development needs of the school. Curie

stated "It's normally us, the teachers, who are pestering Ada about new technology such as

iPads." These teacher technology leaders were staying abreast of current trends in order to

adequately provide experiences to meet the 21st century needs of students. Part of the action

research involved asking students about the technology they regularly used. Curie mentioned

during her interview that she regularly quizzed students about the effectiveness of technology in place and what technologies were new that would improve the lessons. Teacher technology leaders were reading, talking, and researching current trends in order to seek out new tools that may better serve student needs.

I concluded that informal support from teacher technology leaders may prove to be more comfortable and meaningful to faculty members because of the timeliness of peer led support. Some teachers may feel more at ease when asking a question of their colleagues than requesting formal support. Penuel (2006) argued that informal professional development "may be especially important to ensuring implementation success" (p. 338). I concluded that some of these teacher technology leaders built up enough social capital through assisting others to be deemed a reliable source of technology leadership. Throughout the interviews with teacher technology leaders, the names of other teacher technology leaders appeared to testify to an understanding and prowess with technology. Figure 16 represents three areas of technology leadership that were in evidence at Laptop Junior High School.
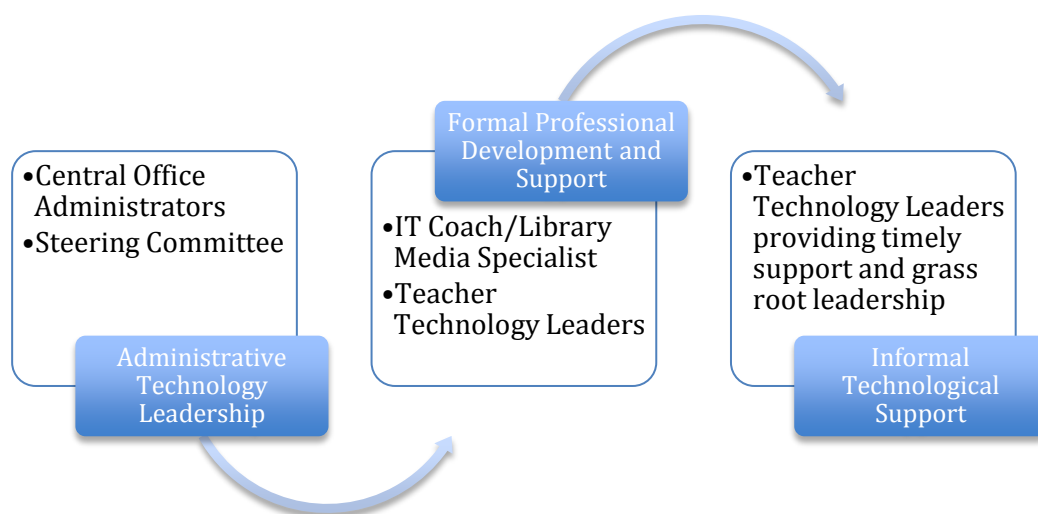
Figure 16. Teacher Technology Leader Ownership of the Laptop Initiative

A strong core of administrators provided an overarching element of leadership that falls in line with Yee's (2000) research and the NETS-A (2009) standards. The leaders provided a shared vision, resource management, modeling, support, and supervision. The arrow leading to the second box represents the top-down leadership that was present at the start of the laptop initiative. The second box refers to the strong level of professional development that took place for one year and continued on a weekly basis. This professional development was based on the school's vision and identified needs. Teachers who have expertise rose to assist in delivering instruction. Finally the third box represents the grass roots movement of impromptu support provided quietly and quickly in hallways, meetings, emails, and classrooms throughout the campus. The interview data suggested that this third or informal level of leadership is where teacher empowerment has surfaced. Leaders in all three levels used action research to move the school forward. It is in the third box that the change in culture occurred and teacher leadership of technology lay some claim to ownership of the initiative.

Figure 17 represents the informal enthusiastic leadership the teacher technology leaders are providing in directing professional development activities and the inclusion of new technologies into classrooms. All seven of the teacher technology leaders declared ownership of the laptop initiative. Curie, Alcibiades, and Archimedes told me that they conduct research and then present their findings to Ada when requesting the purchase of new technologies in the classroom. I discovered that these teacher technology leaders were helping to steer the laptop initiative by providing direction. The arrow directing professional development activities and support represents teacher input into the direction of technology training and usage.

Central Office Administrators
• Steering Committee

Formal Professional Development and Support

• IT Coach/Library Media Specialist
• Teacher Technology Leaders

• Teacher Technology Leaders staying current with technology trends through action research and providing input into the direction of the program

Administrative Technology Leadership

Informal Technological Support

Figure 17. Teacher Technology Leader Ownership of the Laptop Initiative

Research Question 2: How has the One-to-One Laptop Initiative Changed Teacher Technology Leadership Practices?

The research data also suggested that the one-to-one laptop initiative changed teacher technology leadership practices by creating a culture that embraced the laptop initiative and was receptive to changes surrounding technological practices. Before the one-to-one initiative, technology was not readily available for all students throughout the instructional day. Through extensive professional development, resource management, planning time, and positive experiences, school culture has been altered. Shared vision and professional development influenced a pedagogical shift in the way instruction was delivered. Action research was employed in creating a shared vision and guiding professional development activities. With the entire school engaged in using technology throughout the learning process leadership practices took an ad hoc stance in meeting needs as they arose. Action research was used to find solutions to problems. Organizing formal professional development activities takes time and resources

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and with a wide array of technological tools in place, instructional assistance could have been strained at times to meet teacher and student needs. Informal assistance from teacher technology leaders met this need within Laptop Junior High School.

Research Question 3: How do the practices of teacher technology leaders and administrators differ at my model school?

I concluded that the practices of teacher technology leaders differed from administrative technology leadership at Laptop Junior High School. The administrators were responsible for providing and maintaining all technological hardware, software, and infrastructure. They were also responsible for providing the necessary professional development and support to meet the educational needs of the school. Teacher technology leaders have led some of the professional development activities. Teacher technology leaders also collaborated and shared resources with other educators. Sharing resources and collaboration has shaped teacher technology practices. The school's technological vision for the one-to-one laptop initiative began with the three administrators at the board of education office. Teacher leaders became immersed into the vision through action research. Together they returned to Laptop Junior High School with a shared vision of what the laptop initiative could do for the students. The administrators and teacher technology leaders both served as models for technology usage throughout the school. Teacher technology leaders were adaptable to change in instructional practices and technological trends. Administrators and teacher technology leaders were keen to teach others about the use of technology in the classroom. Administrators served as a means to encourage teacher technology leadership. Administrators and teacher technology leaders both served to keep the organization's vision in line with timely support of teaching practices. Administrators served as technology leaders by networking and forming partnerships within the community to support the educational

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process. Teacher technology leaders also provided support by networking with other experts

within the educational community, which provided solutions to problems teacher may face in the

classroom. Finally both administrators and teacher technology leaders served their school as risk

takers by supporting and providing experimentation in looking for solutions to educational

problems. Riel and Becker (2008) argued that teacher technology leaders should move beyond

the walls of the school to contribute to the academic literature. Only one administrator (Ada)

and one teacher technology leader (Cincinnatus) reported returning to graduate school. None of

the participants reported having published or written any scholarly material. Administrators and

teacher technology leaders at Laptop Junior High School experienced a unique opportunity that

could have added to the body of technology literature concerning leadership and one-to-one

laptop initiatives. Sharing their voices and expertise with other schools outside of Laptop

District School System could have been an important act of leadership (Riel & Becker, 2008).

My research only uncovered the findings that Intel reported (2008a; 2008b; 2008c) when they

visited the campus and gathered data about the laptop initiative.

My case study of teacher technology leadership also uncovered the use of action research

throughout the entire laptop initiative. In order to understand the influence of action research on

the laptop initiative at Laptop Junior High School, I created a timeline of events. The following

timeline represents the various stages of the implementation of the one-to-one laptop initiative

into Laptop Junior High School and serves as means of further organizing the chapter.

Timeline

Figure 17 represents a timeline of events that occurred starting in the summer of 2005.

Each block represents a major event in the integration of the laptop initiative at Laptop Junior

High School. The one-to-one laptop initiative began with visionary leadership provided by three

members of the central office staff. These three members identified the need to adequately

prepare students with the necessary skills to join a workforce dependent upon 21st century skills.

Following the experiences shared at the summer one-to-one laptop initiative conference in

Washington, DC, the three administrators selected Laptop Junior High School to pilot the laptop

initiative before moving forward to the high school. After winning approval from the

superintendent, these three administrators created a steering committee to assist in furthering

their vision of the role of technology in classrooms. The steering committee included

administrators from both the junior high school and the system's high school. A core group of

teachers, and some students, joined the administrators in conducting action research in regards to

the feasibility of implementing a project of this scope and whether the one-to-one laptop

initiative would be the correct course to pursue in meeting students' needs. The section on

culture was earmarked by the change as a result of the initiative. Four themes arose from the

data concerning the change in culture. Planning, resources, professional development, and

support were all factors identified by the interviewees as having an influence on the culture of

the school and on teacher practices toward technology usage in the classroom. Finally,

sustainability of culture involved maintaining the forward momentum that was achieved through

the laptop initiative and using action research in order to stay current with technological trends.
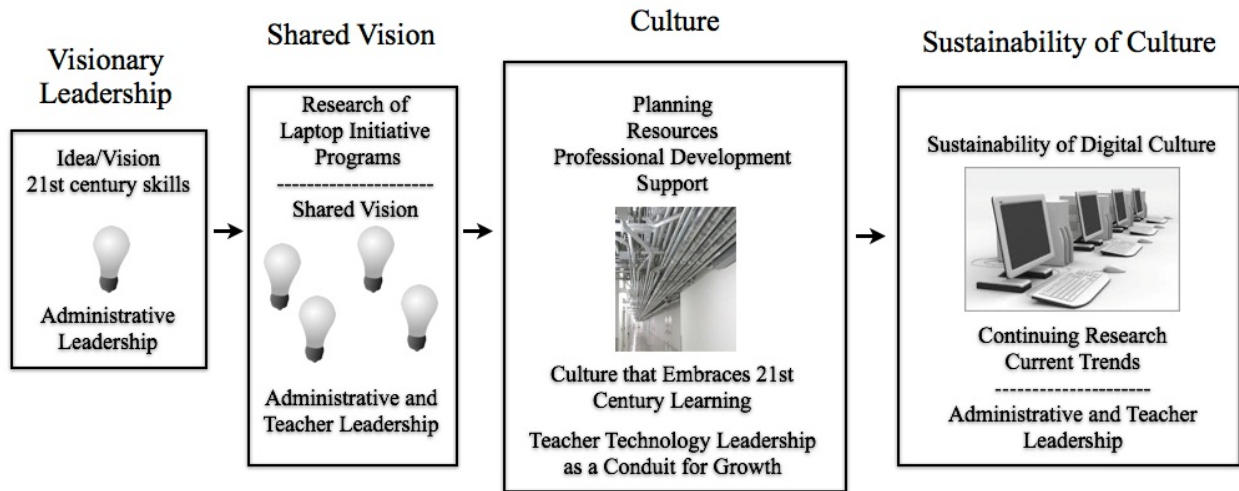
Figure 18. Conceptual Timeline One-to-one Laptop Initiative at Laptop Junior High School

Visionary Leadership

In 2005, the district technology coordinator Ada, superintendent of curriculum Paulo, and chief financial officer Greenspan created a vision that would help meet the technological needs for students in the Laptop School System. These three administrators were served as keepers of the school system's vision (Yee, 2000). Creating a shared vision with all stakeholders is important to successful leadership (Grey-Bowen, 2010; NETS-A, 2009; Senge, 1990). Leaders have to be visionary and share that vision with others by modeling and supporting the use of technological innovations throughout the school (Macaulay, 2009). The result of that visionary leadership, action research and subsequent planning was the implementation of a one-to-one laptop initiative as a means of embedding 21st century skills throughout the curriculum (Intel, 2008a; McLester, 2011).

The one-to-one laptop initiative began with a journey to Washington, DC in the summer of 2005. Paulo, Greenspan, and Ada attended a workshop focused on the meeting students' 21st

century needs. I interviewed Ada and asked her about the origins of the one-to-one laptop

initiative:

> We also knew we had to do, move more in a direction toward 21st century learning skills.
>
> There were a lot of conversations at that conference about one-to-one initiatives. We sat
>
> in on several of the conferences... Greenspan sat on finance side, I sat in on more of the
>
> technology side of it and Paulo sat a lot in the curricular side. So, then when we came
>
> back from that conference we decided this sounds like a good idea. (TBOE, Ada, one-to-
>
> one interview)

These three administrators took what they heard to heart, and formulated a vision of what

they thought a one-to-one laptop initiative would bring to the classrooms in the Laptop School

System. Hypatia, an assistant principal, sounded a similar note:

> The idea was created by some of our school district leaders, who said 'wouldn't that be
>
> great if we could incorporate a laptop program?' So, from that conversations began and
>
> that vision was shared with the school leadership here at that time which I was a partner
>
> and very honored to have been a member. We began researching it, talking to school
>
> districts that already had laptop initiatives underway. We also talked to those who had
>
> attempted but not been successful because we wanted to learn from them as well. (TJHS,
>
> Hypatia, one-to-one interview)

Emmy remembered the events when the three administrators came back from Washington, DC,

and began to devise a plan regarding the one-to-one initiative:

> And so I think that our school system sat down and said 'The world is changing so it's
>
> time for us to kind of start making some plans to change with it so that our students are

more prepared to participate in this 21st century real world as opposed to this paper and

pencil world that's kind of slowly disappearing.' (TJHS, Emmy, one-to-one interview)

Administrators need to develop a vision of a "knowledgeable society" (Hanna, 2008, p.

2). To develop a vision, the administrators need to be in tune with current trends in technology

(Cisco, 2008; ISTE, 2009, Marx, 2006; McLeod, 2011). By researching the merits of a one-to-

one laptop initiative through attending the conference in Washington, DC, in 2005, these three

administrators set in motion a possible solution in helping to prepare students with the necessary

skills to join a digital workforce. Their next step was to share their technological vision of the

future with the superintendent and if approved start formulating a plan to bring the one-to-one

laptop initiative to the Laptop School System. Ada remembered debriefing with the

superintendent of education and he said to her "If you feel that strongly about it, form a steering

committee and compile some research." So the steering committee visited a school system in

Henrico County, Virginia, and the Independent School District in Irving, Texas. The steering

committee also gathered data from the Cobb County School District in Georgia. The laptop

initiative failed to be implemented in the system and the steering committee wanted to gain

insight so as to not repeat any avoidable mistakes. Weber (2009) reported that long-term

planning and teacher leadership through a steering committee were a successful mix at a

midwestern middle school integrating a laptop initiative. I discovered through my interview with

Ada, Emmy and Hypatia that the action research conducted by the steering committee set in

motion the creation of a shared vision among the stakeholders at Laptop Junior High School.

Shared Vision

A shared vision provides the inertia for learning within an organization (Senge, 1990).

Senge (1990) believed that a shared vision created "a sense of commonality that permeates the

organization and gives coherence to diverse activities" (p. 206). Administrative leaders should

strive to create a shared vision for the role of technology within the school (NETS-A, 2009;

Thomas & Knezek, 2008; Yee, 2000). The vision must be the starting point for technology

planning that supports the educational process (Thomas & Knezek, 2008). Hanna (2008) noted

that a shared vision is a way to "build consensus on institutional change" (p. 4). A shared vision

for technology can alter teacher beliefs and create a sense of ownership (Ertmer & Ottenbreit-

Leftwich, 2010; Flanagan & Jacobsen, 2003). A shared vision begins with the administration

(NETS-A, 2009; Yee, 2000). I asked Ada about support from the superintendent. She

responded by relating a conversation she had with the Paulo shortly after being hired. Paulo told

her "No principal will rise above the superintendent and no teacher will ever rise above the

principal. So if you want something to take off first you go to superintendent and get his

approval."

Ada told me she thought this meant that no project would ever get off the ground without

ownership and leadership. After presenting their findings at the debriefing, the superintendent

was quickly on board with the idea. Part of the superintendent's willingness to support this

endeavor may have grown from the successful integration of SMART boards throughout all

classrooms in the kindergarten center. Hypatia remembered the superintendent being impressed

with the student-centered engagement occurring with the SMART boards at the kindergarten

center. She noted that the kindergartners' excitement made a big impression on the

superintendent. Hypatia believed that the first step toward the one-to-one initiative was the

successful integration of interactive whiteboards and the change in culture that had occurred at

the kindergarten center. She relayed to me that if little kindergartners could easily display

technologically savvy skills, then a one-to-one laptop initiative was feasible.

The steering committee included teacher leaders who were picked because of their expertise in their subject area. Being technologically savvy was not a requirement for the steering committee. Ada described the steering committee members as being classified by the subject they taught. She reported that they picked "those teachers who had the trust of other teachers." Hypatia followed suit in describing some of the steering committee members. She stated "we were looking for teachers who had best practices in mind, who were more effective in their classroom, and who would be willing to invest the time and the energy."

Ada informed me that the principals and assistant principals at both the high school and junior high schools were involved on the committee. She stated, "It was teachers from all of the core areas, one special education teacher and a couple of students that sat on the steering committee." I uncovered that the formation of the steering committee was not just a means of making a group decision, but the first big step towards creating a shared vision and altering the school's culture to embrace technology. I assumed when I composed the question that the teachers enlisted for service on the steering committee were to be the school's technologically savvy leaders. Instead Ada, Paulo, and Greenspan chose teachers who are not exactly noted for being technologically savvy but are considered leaders by their peers. I then realized that if the steering committee members were through research and observation could be turned into technology advocates, their presence would become a powerful argument for the initiative.

Once the steering committee was settled, the group travelled to two different school systems where laptop initiatives were in place. Both of these school systems were applauded at the conference for the level of success they had achieved in implementing laptop initiatives in their schools. The steering committee also needed to perform a series of conference calls with one school system that struggled to implement the laptop initiative. The steering committee

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spoke with this system in order to avoid the pitfalls that had interfered with their implementation

of a laptop program (Cohen, 2005a, 2005b, 2005c, 2005d). Ada gave me an overview of the

research performed by the steering committee:

> The steering committee went on the trips to Henrico in Virginia. They also went to
>
> Irving ISD in Texas, and we were all together on the conference call with a school district
>
> in Georgia where the laptop initiative had failed. Once the steering committee became
>
> convinced that the laptop initiative was a good fit for our school district we went to the
>
> board of education to seek approval. Planning for the board of education meeting
>
> included infrastructure, hardware, software, and additional staffing. We devised a ten-
>
> year plan. The board members could tell that we had done our homework. (LBOE, Ada,
>
> one-to-one interview)

The steering committee worked to devise a plan that would best meet students' needs.

One of the lessons learned from other laptop initiatives was to pursue student and teacher

ownership of the process. Hixon and Buckenmeyer (2009) argued teachers could be resistant to

change if the initiative is simply instructions originating at the top with administrators. In order

to be successful, all stakeholders would have to experience some degree of ownership in the

process.

Achieving ownership of the laptop initiative was derived in part from encouraging the

students and teachers to try out sample laptop computers for a three-week period and grade the

machines performance. Emmy explained to me that the teachers "Inspected three different units

over a three-week period." Emmy reported that students were asked to grade which machines

they liked the best, and she said, "students would use them and then they would come back and

jot down notes and decide on which tablet they wanted." Emmy noted that the teachers also

turned in feedback about which unit they liked the best. Teacher and student feedback was

collected and used to determine the laptop tablets purchased for the initiative. Emmy impressed

upon me the importance of student and teacher feedback when launching the initiative. From the

excitement in her voice, I could see that asking the advice of colleagues and students had made a

big impact on attitudes and excitement from the stakeholders. Emmy told me that because the

steering committee gathered feedback from the teachers and students, they helped to establish a

sense of ownership with student and teacher stakeholders during the process (see also Flanagan

& Jacobsen, 2003).

Ada reported that a large part of the steering committee's research involved researching

hardware, software, professional development training, and support. Yee (2000) argued that

administrators should serve as equitable providers to technological resources such as computers,

professional development, and support. Figure 19 represents the budget that was originally

devised by Greenspan and Ada to support the initiative. The budget includes hardware,

infrastructure, software, and professional development costs. Yee (2000) argued that

administrators should strive to identify and provide needed and timely professional development.

Items Description	Unit Costs	Year 1 FY 06	Year 2 FY 07	Year 3 FY 08	Year 4 FY09	Year 5 FY 10	Year 6 FY 11	Year 7 FY 12	Year 8 FY 13	Year 9 FY 15	Year 10 FY 15	Total Costs
Laptop Computers												
# of New Computer Units (Students)	$ 1,200	480	390	440	410	410	420	435	465	510	540	**4,500**
# of Mobile Cart Laptop Units						120				120		
# of New Computer Units - JH (Staff) - Purchase	$ 1,499	80	5	5	5	100	5	5	5	120	5	**335**
# of New Computer Units - HS (Staff)		-	100	5	5	5	120	5	5	5	140	**390**
Total New Units		560	495	450	420	635	545	445	475	755	685	**5,465**
# of Refurbished Units	$ 500		730									
# of Laptops - Teachers K-7	$ 1,530			200				225				
Total Units		560	1,225	650	420	635	545	670	475	755	685	**5,465**
Hardware Costs												
Lease Payments - Laptops		$ 176,400	$ 523,950	$ 728,700	$ 669,375	$ 655,200	$ 670,950	$ 677,250	$ 694,575	$ 732,375	$ 776,475	**$ 6,305,250**
Lease Payments - Laptop Carts (JH)	$40,000/each	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	**$ 720,000**
Infastructure Costs												
Wireless Technology	$50k/campus	50,000	50,000									**$ 100,000**
Software Costs												**$ -**
Future Kids:												**$ -**
Assessment - Jr High	$35/teacher	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	**$ 28,000**
Assessment - High		-	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	**$ 31,500**
Lesson Builder - Jr High	$150/teacher	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	**$ 120,000**
Lesson Builder - High		-	-	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	**$ 120,000**
Professional Dev/Mentoring - JH		8,500	8,500	8,500	8,500	8,500	8,500	8,500	8,500	8,500	8,500	**$ 85,000**
Professional Dev/Mentoring - JH		-	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	**$ 90,000**
Technology Leadership/Adm		15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	**$ 150,000**
Curriculum		30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	**$ 300,000**
Professional Development												
40 hour session/teacher/ JHS	$15/hr	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000	**$ 450,000**
40 hour session/teacher/ JH		60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	**$ 600,000**
Personnel Costs												**$ -**
Technology Specialist (202 Days) - JHS		68,739	68,739	68,739	68,739	68,739	68,739	68,739	68,739	68,739	68,739	
Technology Specialist (202 Days) - HS			68,739	68,739	68,739	68,739	68,739	68,739	68,739	68,739	68,739	**$ 618,651**
Technology Technician (240 Days) - JHS		46,120	46,120	46,120	46,120	46,120	46,120	46,120	46,120	46,120	46,120	**$ 834,700**
Technology Technician (240 Days) - HS			46,120	46,120	46,120	46,120	46,120	46,120	46,120	46,120	46,120	
Miscellaneous Costs												**$ 200,000**
Miscellaneous		20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	
Insurance Costs		10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	**$ 100,000**
												$ -
Total Costs		**584,559**	**1,060,468**	**1,230,218**	**1,170,893**	**1,156,718**	**1,172,468**	**1,178,768**	**1,196,093**	**1,233,893**	**1,277,993**	**$ 11,262,071**

4,046,138

Figure 19. One-to-one Laptop Initiative Budget for Laptop School System

Futurekids Inc's iAssessment (http://www.edtechtrain.com/futurekids/) was an online gap assessment survey that "provided teachers with individualized learning plans that they shared only with their principals" (Intel 2008, p. 8). The budget also reflects the addition of four personnel to provide training; guidance in creating technologically enhanced lessons, technical repair, and support. Providing additional personnel for training and technical support serves to eliminate barriers that could have hampered the laptop initiative (Kopcha, 2008; Lim & Khine, 2006). The steering committee showed a presentation to the board of education. The board approved their plan and the steering committee began to implement their plan for a one-to-one

laptop initiative for Laptop Junior High School. The first part of their plan included creating a shared vision with other stakeholders of what technological possibilities lay ahead for the junior high school.

Culture

Through action research, the steering committee created a vision for student-centered, 21st century instruction at Laptop Junior High School. Ada reported, "We looked for teachers who had best practices in mind and who were more effective in the classroom." She told me "You want people who will critically review the information in front of them." The steering committee armed with their knowledge and a shared vision, returned to the Laptop System as digital disciples and began the process of altering teacher practices through a year of professional development activities, encouragement, and timely support. Ada told me, "professional development activities commenced a year prior to rolling out the laptops to students." The steering committee members understood that fellow teachers' attitudes towards the initiative could make or break the implementation of the program (Hixon & Buckenmeyer, 2009; Penuel, 2006; Trimmel & Bachmann, 2004; Windschitl & Sahl, 2002). Changing teachers' attitudes towards the one-to-one laptop initiative began with the administrators and steering committee reporting their research findings and plans at a series of faculty meetings.

Initial Teacher Reactions to the Laptop Initiative

Cincinnatus, a social studies teacher and technology leader shared that not everyone was excited by the findings of the steering committee. He said, "It was a slow change, and there was a lot of resistance from some of the teachers." Titania, an English teacher and technology leader remembered a collective non-response when the laptop initiative was first proposed at a faculty meeting. Curie, a science teacher and technology leader remembered that the reaction was "Kind

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of mixed with a lot of discussion about the amount of funds to be applied to the initiative." She

said, "There were really just a few folks that were really negative about the initiative at the

beginning." Hypatia also remembered that not everyone bought into the technological direction.

She reported that one administrator from the central office had stated to the faculty "This is

where we're going. If you don't want to go there, maybe you should get off this train and go get

on the other one…" A few of the veteran teachers that had reached retirement age agreed.

Hypatia stated, "We had a few teachers leave because they didn't feel comfortable with it and/or

were not willing to learn or just did not want to change." She said, "Their departures did not

occur overnight, but came about as the culture of the school began to change."

Ada relayed that one of the important pieces of information uncovered during the

research that helped in changing teachers' attitudes came from one of the visits to the

Independent School District in Irving, Texas. They asked the superintendent about what

happened when there were problems with the technology and he replied, "It's not about the box,

it is about the instruction." The superintendent in Texas had said several times that if a computer

is not working the lesson continues. Pencil and paper are pulled out and used. The instruction

continues regardless. She related to me that some of the teachers worried that instruction was

now about technology. She stated to me that it is not about the technology, "we are here to teach

content." Emmy remembered a similar sentiment:

> There were concerns about like damage to the unit, what do you do with the student if
>
> you got a class of 28 and six of them are not working and as a teacher, how are you
>
> dealing with those things? And so we got to talk to a couple of teachers and again they
>
> basically said the same thing. They didn't use this little catch phrase "it's not about the

box" but she said you know if your computer is not working, you're not handicapped.

We do have paper and pencil every single day. (TJHS, Emmy, one-to-one interview)

Emmy remembered that the teachers at the Irving Independent School District reported being

somewhat apprehensive at the beginning of the laptop initiative, but after a time they came to

realize that instruction was at the heart of what they were doing. Emmy told me that the Laptop

Junior High School principal at that time made the statement "I'm not coming by looking to see

if you've got 28 laptops on 28 desks every single day for a hundred and 30 minutes or 99

minutes a day." So she said to me that once teachers realized that instruction was still the

priority and technology was simply another tool to assist in helping to teach, the teachers

breathed a lot easier."

Teachers at Laptop Junior High School learned and incorporated technology at a pace

that best met their schedules and needs. Administrators monitored forward progress by using

technology in classrooms and providing support. Hypatia told me that as she visited classrooms

she often witnessed innovative practices and fresh approaches to teaching. She shared these best

practices with others as she made her rounds. Hypatia's position was a *protective enabler* (Yee,

2000). Through her position as an administrator, Hypatia was capable of steering one teacher

who has needs towards another who may have the creative technological solution to the

situation.

The administrators, Linus the IT Coach, and library media specialist at Laptop Junior

High School served as expert models for technology who can help change teacher practices

(ISTE-A, 2009; Yee, 2000). Ertmer and Ottenbreit-Leftwich (2010) argued that teacher beliefs

and perceptions about technology are based upon the value they see in a technological tool.

Through modeling positive experiences and professional development, teachers are more likely

to be receptive to the use of technology in the classroom. If their professional development

included using the technological tool "within their specific content areas and/or grade levels,

they can more readily transfer that knowledge to their own classroom" (Ertmer & Ottenbreit-

Leftwich, 2010, p. 263).

Ada told me that in the six years the laptop initiative has been in place, most teachers'

attitudes and practices have come to embrace the role of technology in the classroom. Ada said,

> All of our stakeholders have bought into this. It's been very positive for us. We have had
>
> hiccups along the way as you would with any program, but we have found it to be a part
>
> of who we are.

Ada added, "If you were to advise us that we would not have a laptop program at our school

anymore, we would have to reinvent ourselves again because it is so much a part of who we are."

Curie, a science teacher and technology leader, said she would "launch however many

fundraisers were needed in order to hang onto the laptop program." Titania became quite

animated when I asked her what she would do if they had to close down the laptop program.

Titania told me "If the laptop initiative left" she said she "would leave the school in order to go

to work for another system where a laptop initiative was in place." I discovered that all her

fellow teacher technology leaders shared Titania's attitude toward the laptop initiative.

Professional Development

Professional development for Laptop Junior High School began with a gap analysis to

determine the level of technological ability of each teacher. Future Kids Inc. performed the gap

analysis. The gap analysis was an online tool used to measure each teacher's technological

skills. Bernhardt (2004) argued that data should be used to inform the decision making.

Teachers whose scores indicated expertise with certain software were asked by Ada to assist in

providing professional development activities. Teachers whose skills with technology were

limited were provided with additional individualized professional development activities. Some

of the professional development activities included online lessons tailored to meet the individual

needs (Intel, 2008b). Ada stressed to me that the success or failure of the one-to-one laptop

initiative depended upon the quality and amount of professional development. The results of

interviews with the schools in Virginia and Texas plus the conference calls with Cobb County

Schools in Georgia all pointed strongly to the need for professional development. Both Hypatia

and Ada told me that all would have to attend all mandatory professional development activities

before receiving their laptop computers. Ada said, "All teachers had to go through various

structured professional development activities. If they attended all professional development

activities, they would get the devices." The importance of professional development to the

initiative was one the major lessons uncovered by the action research of the steering committee.

<div align="center">
In-District Evaluation
Future Kids Results
January 3-4, 2006
</div>

ID	Other_Title	Activity_Description	Significance	Knowledge	Need_to_know	Suggestions	Recommend	Rating
2120	Future Kids	We were given a self study book and walked through one of the developed lesson plans on day one and worked with a partner to use another of the already developed plans for use in our classroom. On the second day we spent the entire time developing our own technology	The opportunity to work with other colleagues to learn more about computer use and share ideas was most helpful to me.	I feel much more able to instruct students in technology as I've become more comfortable myself with technology just in the last two days.	I still need to become reacquainted with frontpage.	None. I found it very helpful to have so much time to work on applications I can use with my students.	Yes	Excellent
2121	Future Kids	This was a 2-day workshop on implementing technology in the classroom --21st Century Learning Initiative	How to fully implement technology throughout any given unit of study (e.g., a unit on Romeo and Juliet).	I fully expect this new training to benefit my students on all levels once their laptops have been issued! This style of teaching will completely engage and maintain students' interest!	I am eager to learn more about additional techniques available through technology for use in my classroom lessons	I strongly feel that giving teachers time to plan lessons through technology is a great benefit; therefore, it would be helpful to have more time devoted to the actual "lesson building" process	Yes	Excellent
2122	Future Kids	strategies to integrate technology into the classroom on a regular basis	using technology as a tool to teach, not just an evaluation tool	It will highly impact learning and achievement.	web page design and access	Give us the manuals ahead of time so that we could peruse them before the workshop.	Yes	Excellent
2123	Future Kids	Infusing Technology	How to use programs that I already use more effectively.	Tomorrow, I will begin to use them in two lessons.	Everything! Most specifically, I need to work on FrontPage and using it to interface with student writing	As with ALL tech workshops, still need more time (not a function of Future Kids, just a function of the fact that there's never enough time).	Yes	Excellent
2124	Future Kids	21st Learning Training - computer seminar	That I know less about computers than I thought	I can implement technology into my classroom more effectively	how to use various softwares	none	Yes	Good
2125	Future Kids	We created lesson plans to integrate technology into lessons.	How to integrate technology and create lessons	It will help with integrating the laptops into my curriculum.	charts, webpages, webquests, links	It was good - I appreciated being given time to work on an actual plan.	Yes	Very Good
2126	Future Kids	To evaluate individual computer and technology skills.	Receiving a list of my technology weaknesses.	I know what specific areas I need to focus on when trying to integrate technology into my lessons			Yes	Good

<div align="center">
Page 2   FutureKids_Results.xls
</div>

Figure 20. Future Kids Gap Analysis

Ertmer and Ottenbreit-Leftwich (2010) argued that teachers should have some mastery over technological tools before they attempt to use them in the classroom setting. Teachers need to serve as models if they expect to effectively lead students in the use of technology (NETS-T, 2008). Hew and Brush (2007) theorized that before teachers can expect to be effective models, they must also have a solid grounding in best practices using technology. Teachers need to be able to select and use the technological tool with the best fit in regards to the content of the material being taught. The steering committee uncovered early on in its meetings with other laptop initiative schools that the teachers at Laptop Junior High School would have to be able to master a plethora of digital tools that would become available to them through the laptop initiative. The steering committee (Intel, 2008b) decided after conducting their research that extensive professional development would have to occur in four areas:

- Curriculum tools

- Software basics

- Behavior management

- Transformational learning

I discovered that this phase of the laptop initiative was the most critical. Continuous feedback and ongoing research was used to guide and refine professional development and support. Ada told me that teachers were asked at the conclusion of every professional development activity whether they understood everything that was taught in that training session. If the teachers felt unsure, Ada would reschedule next week activity and have this material taught again. Ada stressed to me that the success of the laptop initiative hinged upon the success of the professional development. I discovered from Ada that some of the teacher technology leaders whom I interviewed had delivered professional development instruction during these training

sessions. When Ada told me this the first thing that popped into my mind was that teachers would feel more comfortable asking a person they know for help instead of relying upon assistance from a stranger. I believe it was at this juncture of the process that informal teacher technology leadership first made an appearance at Laptop Junior High School.

IT Coach and Library Media Specialist

Linus the IT coach and the library media specialist for Laptop Junior High School provided professional development training and technology support. Linus told me that they had weekly technology training that was arranged and sometimes led by either the library media specialist or himself (see also Levin & Wadamy, 2008; Penuel, 2006). Linus informed me that teachers were required to attend one hour of training per week or "Tech Tuesdays" starting in 2006 (Intel, 2008b). In 2007 training occurred every "Wi-Fi Wednesday." These weekly training sessions were mandatory for all faculty members. Linus and the library media specialist conducted a large majority of the presentations. Most of the sessions today are no longer mandatory and teachers can request small group and individual sessions of professional development. Archimedes and Alcibiades both remarked when asked about the role of the IT coach that he often provided individual training and support in creating technology-based lessons for the course of study. Archimedes stated that Linus was "good at locating resources and creating especially when they involved science and math." Archimedes told me that sometimes Linus, who had taught physics, had suddenly popped into his class after hearing what is being taught and interjects a different angle on how to incorporate a piece of software or equipment in order to better explain what was being taught. Cincinnatus relayed to me a similar incident involving the library media specialist. He said that the library media specialist had attended a workshop and came back to school with information about an online interactive map system

titled Stratalogica. Stratalogica (http://www.stratalogica.com/) provides a rich variety of

reference and collaborative tools plus an interactive map system that allows users to create and

participate in virtual tours. Cincinnatus reported that during one of the horizontal planning

meetings, the library media specialist demonstrated the product to the social studies department.

Cincinnatus reported that her efforts at demonstrating this new software led to the social studies

department adopting Stratalogica as a classroom tool.

Figure 21. Stratalogica (http://www.stratalogica.com/)

In their study, Norum, Grabinger, and Duffield (1999) described the library media

specialist in their study as the "go-to" person for sharing information and training the faculty

about new technology. They discovered that the individuals providing support should be patient

and have the experience and forethought to anticipate technology needs. Determining these

needs means staying current with the literature and other experts (Fitzallen, 2005). Riel and

Becker (2008) argued that one characteristic of teacher technology leadership is the teacher's

willingness to change pedagogical practices in order to stay up-to-date with current technological

trends. The library media specialist and Linus are teacher technology leaders at Laptop Junior

High School who have striven to place innovative tools into the hands of educators. The data

suggests that Linus and the library media specialist provided both formal and informal technology leadership to the faculty.

Collaboration

Riel and Becker (2008) discovered that teacher technology leaders willingly collaborated with other teachers. Cincinnatus gave me a glimpse of the casual nature of collaboration and support occurring among the faculty, "My classroom is connected to your classroom. Everything that we all do affects each other and there's more collaboration between us all." Archimedes said the same thing when he told me:

> Alcibiades is a technology guru. We are cut from the same piece of cloth. It's not unusual for us to meet in the hallway where he will show me something that he has discovered about technology. We start talking back and forth about how to incorporate this into our lessons, and then we go our separate ways. (LJHS, Archimedes, one-to-one interview)

These people were discussing ideas and new practices with technology in informal settings. These people struck me as being extremely passionate and proud of the level of expertise, integration, and collaboration occurring with technology. Cincinnatus commented, "I think that technology has forced us to become more collaborative as a school." He later noted that technology had become a catalyst for change in the way teachers plan, communicate, and deliver instruction (see also Fitzallen, 2005; Lane & Lyle, 2009). Because of the change in the culture at Laptop Junior High School, Cincinnatus believed there was more collaboration particularly in regards to the horizontal planning that occurs at the department level. He said, "We share a lot of digital resources. Horizontal planning is a really good use of time. I think that all of our social studies teachers are more on the same page now than we've ever been." Curie,

the science teacher, sounded a similar chord about collaboration when she said, "All of the science teachers met last week and we were shown how to use the motion sensors in classroom lessons. The lessons we created with these devices have been shared on our teacher folder on the server." When I revisited Cincinnatus and Curie's statement an image entered my mind of a worker bee returning to the hive with news of nectar. These teacher technology leaders are moving about in meaningful ways throughout hallways and classrooms. The collaborative and supportive actions of teacher technology leaders among the faculty members have resulted in a culture that embraces the one-to-one laptop initiative (see also Intel, 2008a, 2008b, McLester, 2011).

An important aspect of the collaboration is the shared network folder. All of the teachers whom I interviewed mentioned the shared teacher folder as the place where digitized documents were stored. Shared folders were a way for teachers to model collaboration and teamwork (NETS-T, 2008). At my school, we used a shared folder on the server as a repository for Power Points, primary sources, textbook materials, and computer fixes. We called it the "virus folder" because I originally used it to store antivirus fixes as I moved from room to room and repaired machines. In 2006 we opened the folder to teacher use. They used the folder to store and share files. It was also a starting point for technological integration. I have often overheard teachers discussing files and resources in the virus folder. I discovered that this same sharing and similar conversations were taking place at Laptop Junior High School. With the image of teacher technology leaders as collaborative worker bees who make academic progress through technological directions, I envisioned this shared teacher folder as the hive for collaborative storage and conversation. I discovered that collaboration and technology leadership was quietly taking place behind the scenes through teacher use of the shared network folder to start digital

conversations. The interview data suggest that this informal, behind the scenes leadership is as important as the formal leadership provided by the administration, Linus and library media specialist. I got the impression that these teachers had ownership over the technology. I discovered that this sense of ownership is a direct result of the shared vision and stakeholder involvement that occurred when the system was performing action research in Texas, Virginia, and Georgia. McLester (2011) discovered that Ada and the steering committee used "deep research and input from all stakeholders" (Establishing a technological culture, para. 4).

When asked about collaboration, Archimedes said, "It's a very collaborative environment at Laptop Junior High School. We have got a lot of different people doing a lot of really neat things." Cincinnatus, who had been teaching 8th grade for roughly a decade, charged that technology had opened the door for collaborative communication and planning. He stated, "I think that the laptop initiative has really forced us to collaborate more." Penuel (2006) noted that teachers often turned to peers for a quick solution or guidance. Considering the amount of activities and the workload, it is easy to understand the need for quick answers. When you can email a person or step next door and ask for help, it is much quicker than waiting for a technical expert to block out some time for a lesson. Access to resources and open discussion of new ways of doing things was a recurring thread throughout all ten of the interviews.

I also interviewed one new teacher in the history department who had benefited from collaborating with colleagues. Roosevelt told me that he had a solid understanding of technology. Where he said he needed help was with understanding how the technological tools available to the school fit in with teaching the lesson. Hixon and Buckenmeyer (2009) argued that teachers need support so that they obtain a level of practice in which technology has become an integral part of the instructional process. Roosevelt confessed to me his need for collaborative

assistance from others, "I'm still trying to catch up to everyone else's as far as their knowledge

of what we can and can't do with this. When asked about helping incoming teachers, Emmy

provided a similar answer regarding a new teacher down the hall. She said that she emailed her

"all my unit breakdowns, and all the DyKnow panels that I use." She said that the novice teacher

could easily "go in and tweak the materials instead of making them from scratch." Such sharing

makes best use of preparation time and builds social capital with the teacher technology leader.

Teacher technology leaders build "social capital" (Riel & Becker, 2008, p. 413) through

mentoring, coaching, and sharing resources, ideas, and giving timely assistance. Teacher

technology leaders can assist others by providing assistance of either a technological or

pedagogical nature. Such assistance builds social capital among colleagues and can serve as a

conduit for new ideas and most effective practices (Riel & Becker, 2008).

When I asked Ada what the next technological chapter would be for Laptop Junior High

School, she mentioned project-based learning. She thought that the level of collaboration and the

technology that was in place was a good foundation for this next shift in teacher practices. She

told me,

> Our next step is project-based learning. Our teachers do a lot of that now but one of the
>
> things that we're looking at is how to bring together reading and social studies, and also
>
> science and math. We need to make these project-based lessons more relevant to the
>
> students. (LBOE, Ada, one-to-one interview)

Cincinnatus provided an example of project-based learning that occurred between his department

and the language arts department:

> The language arts teachers had this idea about using the novel *The Hunger Games* as the
>
> center for a project-based assignment. There is a movie coming out next semester, and it

has a lot of historical stuff and geography stuff. The language arts teachers asked us to

work with the social studies department in developing an interdisciplinary unit that starts

in language but it carries over into history. (LJHS, Cincinnatus, one-to-one interview)

Levin and Wadamy (2008) suggested that teachers would profit from collaborative

opportunities with colleagues on issues directly related to instruction with technology. I

discovered that the laptop initiative at Laptop Junior High School had opened doors for

collaboration and sharing. The collaboration and positive experiences have assisted in bringing

about a change in the school's culture, making it possibly more receptive to future changes in

pedagogical practices.

Sustainability of Culture

Changing teacher practices towards integrating technology in the classroom in early 21st

century schools could alter a school's culture (Riel & Becker, 2008). In the case of Laptop

Junior High School, all of the personnel interviewed, including administrators, embraced the role

of technology as an accepted part of the school's way of doing things. When speaking about the

amount and level of professional development needed to reach this level of success, the teachers

and administrators demonstrated a tone of pride. I seldom heard "I do this …" but more often

heard "We do this because…" and this gave me a real sense of the level of sharing and

collaboration taking place. Curie (science teacher) provided a prime example of the

collaboration taking place at Laptop Junior High School. She told me she regularly collaborated

with two language arts teachers and the IT Coach Linus when designing projects. She put forth

the example of the green school project in which the students were asked to do research about

the chemicals in the cleaning supplies used in the school. Part of the project involved penning a

persuasive business letter to the superintendent of education regarding the future purchase of

green cleaning supplies. Linus (IT Coach) helped to design a web quest of businesses and schools that have incorporated the use of green cleaning supplies.

I discovered that these people were quick to praise others for their assistance and collaborative spirit. All of my interviewees were positive and humble in discussing their role as teacher technology leaders within the school. Titania (English teacher) provided an example of this humility. She told me "We share a lot of great resources. I cannot take credit for all the resources shared among the English faculty." She further noted that within the English Department "We have a common drive where we can put our files so that we don't have to reinvent the wheel." All of the teacher technology leaders basically said the same thing regarding the professional development activities occurring now.

The same camaraderie appeared in the data regarding professional development opportunities. I uncovered that the teacher technology leaders were the ones asking and directing what is being delivered. The sessions were no longer mandatory and from the top, but became instead a timely solution to a "think tank" setting in which a group of teachers brainstormed a new technological need into existence. I asked Emmy who drove the selection of professional development activities and she said "The faculty." In other words the professional development opportunities have become small group, ad-hoc, brainstorming exercises to meet specific needs that have arisen. Emmy told me that a number of the faculty wanted to start using Moodle as a learning resource to help prepare students for online learning. Linus provided the necessary training and that training led to Moodle being added to the server. Lave and Wenger (1991) would describe this as "Communities of Practice" because these teacher technology leaders were helping to drive the organization forward through technological expertise.

Leithwood, Leonard and Sharratt (1998) argued that organizational learning occurs because of an emerging problem or need. They further noted that school leaders exert a major amount of influence in directing organizational learning. Senge (1990) discovered that leaders work as facilitators to help teachers to "understand complexity, clarify vision, and improve shared mental models" (p. 340). The impression I received from all of the interviews with both the administrators and teacher technology leaders is that adventurous learning and thinking outside the normal boundaries was encouraged. These teachers were eager to try and explore new technologies. Curie shared an example with me regarding several teachers' thoughts regarding new technologies. She said, "It's normally us, the teachers asking for stuff. We're always dropping hints to Ada about the need to integrate iPads into the classroom." We told her through her Twitter account that, "We would be more than willing to pilot an Apple iPad program in our classrooms." Curie told me they are always "Reading about stuff, and keeping up-to-date with technological trends." In schools where organizational learning is supported by the leadership, collaboration, risk taking, and continuous professional growth are encouraged (Senge et al., 1994). I have discovered through experience that integrating technology into schools where teachers are hesitant or unwilling is an uphill battle. Teachers who were motivated and enthusiastic about incorporating new tools are the ones I started with first when looking for assistance in bringing new tools to the classroom.

According to Lave and Wenger (1991), learning is a product of living and working in a community. In order to maintain the community's existence, new members need to have a shared experience. Hoadley and Kilner (2005) argued that knowledge is the "property of the people in the community" (p. 32). This knowledge comes from the ebb and flow of information between members in the community. New members grow in their experiences and knowledge,

gradually becoming experts in their place in the community (Piaget, 1973; Vygotsky, 1978). Individual experts and leaders sometimes merge together in temporary associations to solve issues and to grow in knowledge about a subject. These experts meet face-to-face or electronically to form "Communities of Practice" (Wenger & Snyder, 2000). Wenger and Snyder (2000) argued that meaning within communities of practice involves "participation and reification." Reification results from the creative answers to problems. These individuals "share their experiences and knowledge in free-flowing, creative ways that foster new approaches to problems." I discovered that there was a lot of open exchange of ideas and solutions taking place among the teachers I interviewed. Hypatia told me that the integration of technology throughout the curriculum at Laptop Junior High School became a major part of everyday life.

> Technology is very much a part of who we are now and teachers who are or people who were interviewed for positions here know that that's an expectation. So, if you're coming to join us, this is part of what you're going to be expected to do. So, we work very hard to help train them as quickly as possible and give them a good support network. (LJHS, Hypatia, one-to-one interview)

I got the impression from speaking with these teacher technology leaders that ideas and assistance moved at a very fast pace. All of the teachers conveyed to me that support was never lacking. I discovered that these teacher technology leaders had formed a community of practitioners that worked to support the integration of technology. I believe that the communities of practitioners flourished because of the collaboration and continuous planning that occurred.

Teachers Networking in Technology-Active Communities

Some of the teacher technology leaders at Laptop Junior High School reported networking with other technology experts outside of the school. Titania told me, "There are

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networks among the faculty members and probably outside the school with which these folks converse and share." She further mentioned that some of the teachers have either worked at the nearby university or have contacts with whom they can communicate. The Laptop district website (http://www.auburnschools.org/Technology/) identified Intel, Gateway, and SMART Technologies as partners with the school system. Ada told me that both Intel and Gateway provided expertise advice in locating resources and answers to problems. Linus, the IT coach reported that both he and the library media specialist regularly attended conferences and workshops with outside experts in order to bring new ideas and tools back to the school. Linus told me that he infrequently consulted other technology experts outside of the system. Most of his contacts worked for the Laptop School District. I also asked if he contacted technology experts at the nearby university and he said no.

Alcibiades told me that he is currently collaborating with history professors in the nearby university to bring history alive in the classroom. Persistent Issues in History (http://pihnet.org/) is a web-based program that connects historical issues with current events (Intel, 2008b). The program offered educators an opportunity to collaborate and design lessons with other professionals nationwide. Alcibiades told me that Persistent Issues in History offered a collaborative digital platform that permitted a network of history experts to design history lessons that may be more relevant to students. The interview data suggest that teacher technology did interact to a degree with technology-active communities outside of the school. I believe educators regularly visit the school looking for assistance and expertise.

Current Trends in Technology

Staying current with technological trends required action research on the part of all technological leaders. When I asked the question what is the next step in the laptop initiative

three of my participants Curie, Emmy, and Ada, mentioned Apple iPads. Emmy told me, "I wish we would get iPads, I do but I don't think that we are going in that direction yet. I think the app thing will have to be honed a little bit to kind of get to where we need to be." I asked her if interactive textbooks were a factor and she said, "I would love our textbooks to be an iPad app that we could download, and I think the textbook companies are moving in that direction but we are not quite there yet." Hu (2011) reported that Apple is busy working with textbook companies to provide e-textbooks that are interactive. Sun, Flores, and Tanguma (2012) reported e-textbooks could include "searches within the text including interactive tables and figures, hyperlinks to related topics, case examples, and links to videos which can facilitate learning" (p. 64). Ada gave a similar answer about the iPads. She said that they had asked students who had iPads which they would rather use at school. Ada said that the students replied, "iPads are great but for schoolwork, I'd rather have a laptop." Ada expressed her concern that some educators may be getting swept up in the hype surrounding the devices. McClanahan et al. (2012) discovered that iPads have the potential to be useful tools given that the application fits the specific needs of the student. Ada was fearful that once the initial interest wears off some school systems might come to a realization that as of now there are limits to the devices. She told me "Everything around the iPad is about the app. Okay, we're not here to teach apps. We're here to teach content." She further explained about problems related to the iPads. She told me:

> Apple has just come out with a textbook app for the iPad. I met with an Apple
> representative on Friday; they're $14.99 per textbook. Well, $14.99 times 500 kids is
> $7,000 per year. The problem with this is that textbook is assigned to that child not to
> that school. I don't have the ability to take and reassign that license over and over again
> and that's not a good way to utilize funds. (TBOE, Ada, one-to-one interview).

Staying current with technology in the literature is important if Laptop Junior High School is going to continue to provide 21st century skills needed to operate on a global and virtual stage. Ada and other technology leaders used action research to investigate potential tools and cutting edge resources that met the shared vision of Laptop Junior High School.

According to my interviews, teacher technology leadership was flourishing at Laptop Junior High School. Teacher technology leaders were actively engaged in assisting colleagues in the implementation of technology across the curriculum. The school's culture had shifted toward a collaborative environment where teacher technology leaders were staying abreast of trends and solutions to help meet students' instructional needs. The shift in culture began with the inclusion of teacher leaders on the steering committee. The empowered teacher leaders were converted through their observations, interviews, and research data gathered from schools in Texas and Virginia. The culture that I witnessed through the interview process was one of passionate experts striving to make the one-to-one laptop initiative a successful part of the instructional process. Their efforts as well as those of the administrators have created a shared vision for the integration of 21st century skills throughout instruction. The shared vision started with the empowerment of student and teacher voices into the research and adoption process. Professional development followed on the heels of the adoption process. The professional development guided by the action research of the steering committee assisted in altering teacher beliefs and helped change teacher practices. According to my participants, the year of continuous professional development resulted in a technological shift in teacher practices throughout the school. I concluded that teacher technology leadership emerged during the research and professional development phase of the laptop initiative. Teachers who were knowledgeable and comfortable with presenting to their peers began to deliver technology instruction in both formal

and informal sessions. These teacher technology leaders were continuing to lead by researching technological trend and serving as technology advocates in order to better prepare students for life in the 21st century. Action research served as a tool for integrating the laptop initiative into Laptop Junior High School.

CHAPTER 5: SUMMARY OF FINDINGS, IMPORTANT AND NOVEL CONTRIBUTIONS,

IMPLICATIONS FOR PRACTICE, AND IMPLICATIONS FOR RESEARCH

Summary of Findings

Our society is part of a digitized domain in which the ebb and flow of electronic

information and computerized tools is ever changing (Cisco, 2008; Intel, 2008a; Liu, 2010;

Prensky 2009; Prensky 2010). Futurists (Prensky, 2009, 2010; Silva, 2009), researchers (Bell,

2010, Liu, 2010; McLeod, 2011; Pappas, 2009), and business professionals (Partnership for 21st

Century Skills) propose that students will need experience with media and communication tools

in order to become effective producers in the workplace. They also propose that Digital Age

workers will have to be creative thinkers and problem solvers who are capable of working with

team members in both real and virtual realms (Jukes, McCain, & Crockett, 2010; Silva, 2009).

Schools are charged with preparing today's students to join a digital workforce (Cisco,

2008). Flanagan and Jacobsen (2003) argued that administrators should provide schools with

technological leadership. Many school administrators are unprepared to lead the integration of

technology throughout the curriculum (Cuban, Kirkpatrick & Peck, 2001; Flanagan & Jacobsen,

2003; Riel & Becker, 2008; Schrum et al., 2011). In some schools teacher technology leadership

has arisen to assist in leading the implementation of digital tools across the curriculum (Dexter,

2011; Flanagan & Jacobsen, 2003; Katyal, 2010; McLeod & Richardson, 2011; Riel & Becker,

2008; Yuen, Lee & Law, 2009). These teachers who are technology experts have moved beyond

the confines of their classrooms to assist others in meeting technological needs (Dexter, 2011;

Flanagan & Jacobsen, 2003; McLeod & Richardson, 2011; Riel & Becker, 2008; Yuen, Lee & Law, 2009). I uncovered that teacher technology leaders at Laptop Junior High School strove to integrate 21st century skills throughout the school by altering teacher practices through professional development activities, timely support and guidance. These teacher technology leaders found themselves at the intersection of technology integration and leadership as they strove to assist school administrators in preparing students for life in the Digital Age (Dexter, 2011; Katyal, 2010; Luthra & Fochtman, 2011, Riel & Becker, 2008).

In 2005 Laptop Junior High School began the implementation of a one-to-one laptop initiative as a means of preparing students with the necessary work skills for the 21st century. Riel and Becker (2008) concluded that with the expansion of technology into schools, "a significant number" of educators "became strong advocates and leaders for establishing a wider role for computers in the instructional practices of their colleagues" (p. 397). The purpose of my case study was to follow up on the research of Riel and Becker (2008) and investigate what teacher technology leadership looked like in a model school.

The following questions guided my case study:

1.   What is the nature of teacher technology leadership at Laptop Junior High School?

2.   How has the one-to-one laptop initiative changed teacher technology leadership practices?

3.   How do the practices of teacher technology leaders and administrators differ at my model school?

I formulated these guiding questions from the (a) qualitative administrative technology research of Yee (2000); (b) the National Educational Technology Standards for Administrators

(2009); (c) the National Educational Technology Standards for Teachers (2008); and (d) teacher technology leadership practices of Riel and Becker (2008).

Yee (2000) gathered thick descriptions from administrators in New Zealand, Canada, and the United States. She interviewed principals who had been identified as technology leaders in their respective schools and through their partnerships with local colleges. These principals led the integration of information and communication technology throughout the schools. Her interviews uncovered eight administrative practices that served as part of a framework for my case study.

The five broad practices identified by NETS-A (2009) served as a lens for my administrative data:

- Administrators should serve as visionary leaders who seek to create a shared vision of the role of technology throughout the school.

- Administrators should actively promote a Digital Age learning culture that supports the 21st century learning needs of all stakeholders.

- Administrators should promote a professional environment that supports technology usage.

- Administrators should strive to lead systematic improvement throughout the organization.

- Administrators should serve as models to promote digital citizenship.

I viewed my teacher technology leadership data through the five practices identified by the NETS –T (2008). These practices included (a) inspiring and facilitating student learning; (b) designing and developing Digital-Age learning experiences; (c) modeling Digital-Age work; (d) promoting digital citizenship; (d) and engaging in professional growth and leadership. These

overlapped with the teacher technology leadership practices identified by Riel and Becker (2008). They identified:

- Teachers Learning with Technology

- Teachers Collaborating around Technology

- Teachers networking in Technology-Active Communities

- Teachers Contributing to Knowledge About Educational Technology

Using these four frameworks as a lens to view my data, I interviewed seven teacher technology leaders, two administrators, and one new teacher who benefited from the leadership of technology experts within the school. Each of my interviews lasted between 30 to 50 minutes and was conducted in the classroom/office of each participant.

Through my analysis of the data, I discovered that the laptop initiative served as a medium for change in the school's culture. Teachers who were empowered as technology leaders became agents of change, who transformed teacher practices through formal professional development activities, guidance, and informal timely support. According to all of the participants, the laptop initiative has provided a thoroughfare for implementing 21st century skills into daily instruction.

Figure 22 represents three areas of technology leadership that were present at Laptop Junior High School.
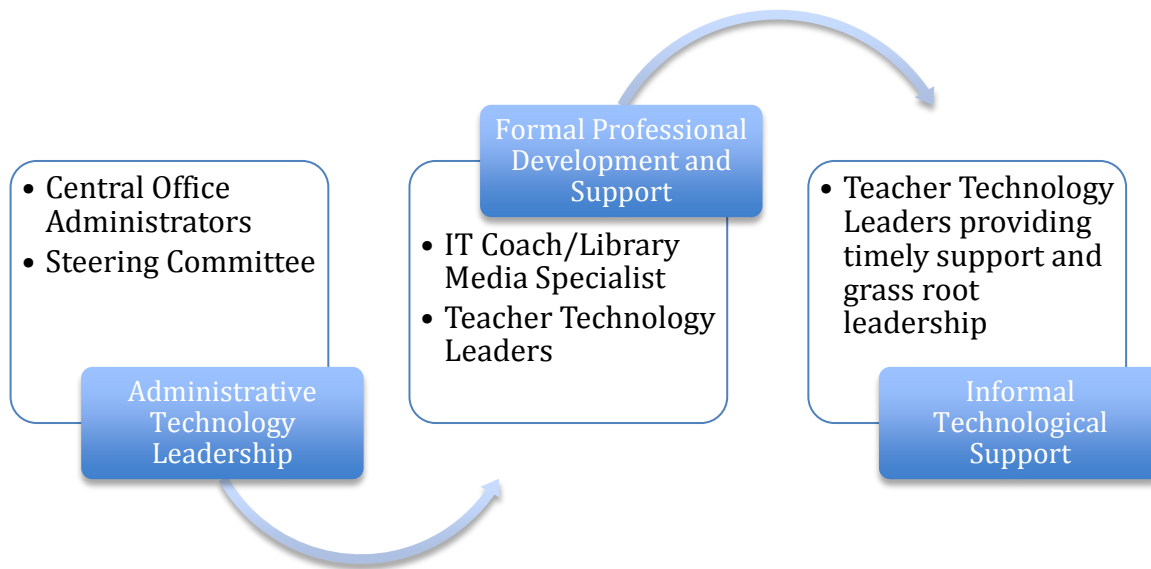
Figure 22. Administrative Leadership of the Laptop Initiative

The first box represents administrative leadership. The arrow represents the top-down leadership

in guiding the initial implementation of the laptop initiative. Administrators working together

with the steering committee served as technology leaders in creating a shared vision for the

inclusion of 21st century skills throughout classrooms. As a result of action research, the

administrators and steering committee created a plan that provided the necessary resources and

support to implement a one-to-one laptop initiative. The second box represents the year of

professional development activities that altered teacher practices. Teacher technology leaders

arose during this point in the integration of the laptop initiative to formally lead many of the

professional development activities. The steering committee conducted action research to gather

feedback and provide direction for professional development activities. It was during this period

that teacher technology leaders Linus and the library media specialist were appointed to assist

teachers in creating technologically rich lessons. The arrow emanating from the second box

represents the top-down structured regimen of the weekly professional development activities

that were a requirement in the initial year of the implementation. The third box of the pyramid

represents the informal technology support that teacher technology leaders provided. Teacher

technology leaders moved about the building and provided timely assistance to fellow teachers.

I concluded that teacher technology leaders had become "strong advocates and leaders" (Riel &

Becker, 2008, p. 397). Their informal, enthusiastic leadership, coupled with a shared vision for

the program resulted in a strong sense of ownership. Teacher technology leaders, wanting to

help guide the future direction of the technology within the school, used action research in

uncovering future trends and problem solving solutions. Their research and timely

communications with Ada helped in providing feedback and sustaining the forward momentum

of the laptop initiative. My interviews were conducted five years into the implementation of the

laptop initiative. Figure 23 represents teacher technology leader's input into the direction of the
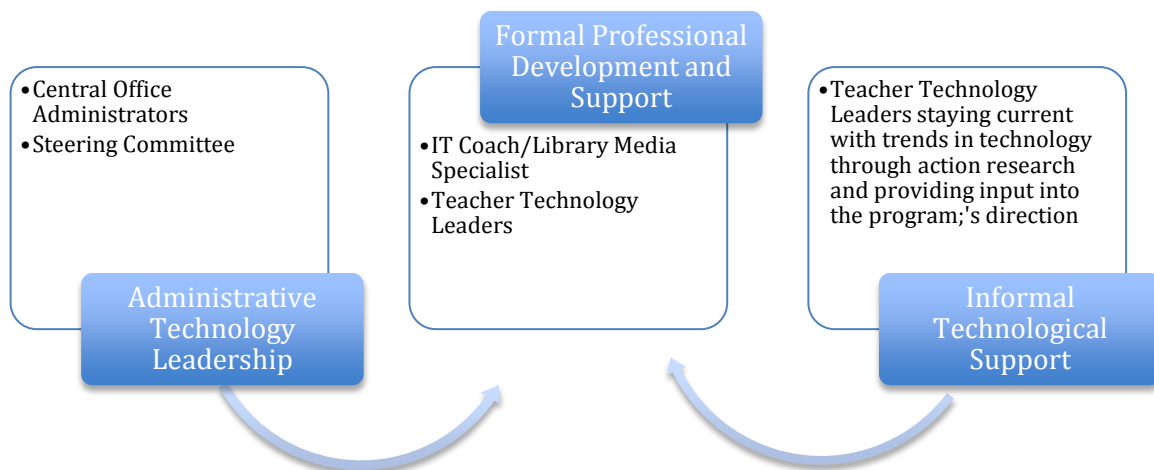
laptop initiative.

Figure 23. Teacher Technology Leader Ownership of the Laptop Initiative

I concluded that the grassroots leadership provided by teacher technology leaders is an indicator of cultural change having occurred at Laptop Junior High School. At an informal level the teacher technology leaders provided direction in the course of technology selection by volunteering feedback to the district technology coordinator. The second arrow in Figure 23 represents teacher technology leaders directing professional development activities regarding new technologies. Teacher technology leaders worked with fellow faculty members to collaborate in creating technology infused lessons for the classroom. They also provided timely formal and informal technology support to fellow faculty members. I observed a strong sense of ownership from all seven of the teacher technology leaders I interviewed. They were all very excited about the role of technology within their classroom and their ability to help lead the educational process throughout the school. They each viewed the one-to-one laptop initiative as a revolutionary experience in the way instruction was delivered to the students.

I also concluded that the teacher technology leaders at Laptop Junior High School were engaged in three of the four practices identified by Riel and Becker (2008). Riel and Becker (2008) identified four practices of teacher technology leadership:

- Teachers Learning with Technology

- Teachers Collaborating around Technology

- Teachers networking in Technology-Active Communities

- Teachers Contributing to Knowledge About Educational Technology

Teacher technology leaders at Laptop Junior High School were flexible in altering their pedagogical practices to include new technological tools. Curie told me that she regularly solicits feedback from the students in designing new lessons using technology. All seven of the teacher technology leaders emphasized their willingness to adopt new products into the learning

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process. From interview data I uncovered that all seven of the teacher technology leaders collaborated with their peers regarding technologically based lessons and networked with other technology leaders. All of the teacher technology leaders emphasized the pivotal role of a shared network folder for teacher materials. None of the teacher technology leaders reported to having written or contributed to the academic body of knowledge at the collegiate level regarding the role of technology within the school. Several of the teacher technology leaders reported interacting with a nearby university. Titania reported that she had served as an adjunct French instructor. Alcibiades reported that he had partnered with several professors from a nearby university to support an online program entitled Persistent Issues in History (http://dp.crlt.indiana.edu/). Cincinnatus has returned to graduate school in pursuit of an advanced degree but has not contributed to the academic body of knowledge regarding the laptop initiative at Laptop Junior High School.

I also discovered that action research was used throughout the laptop initiative. I created a timeline of events in order to illuminate action research in the process. Kurt Lewin (1946) proposed the term action research to describe research composed of planning, implementing the planned action, and publishing/reflecting on the results of the action in order to address problems and improve practices. Goodnough (2011) concluded that action research can be cyclical and may lead to communal reflection and public meanings. Interviews with administrators and teacher technology leaders revealed that the steering committee's action research set in motion a series of events which changed the culture of the school to embrace technological change. Hypatia summed it up best: "The idea was born by some of our school district leaders, who said 'wouldn't that be great if we could incorporate a laptop program?' So from that conversations began and that vision was shared …" The shared vision had a its heart the concept of preparing

students for life in the 21st century. Emmy struck a similar chord when she stated, "The world is changing so it's time for us to start making some plans to change with it so that our students are more prepared to participate in this 21st century real world as opposed to this paper and pencil world that's kind of slowly disappearing." Three district administrators attended a technology conference in the summer of 2005. Ada, Greenspan, and Paulo travelled to Washington, DC, where they were exposed to schools leaders that had implemented laptop initiatives. After the three administrators returned from the conference, the superintendent directed them to form a steering committee to further investigate if a laptop initiative would meet student needs.
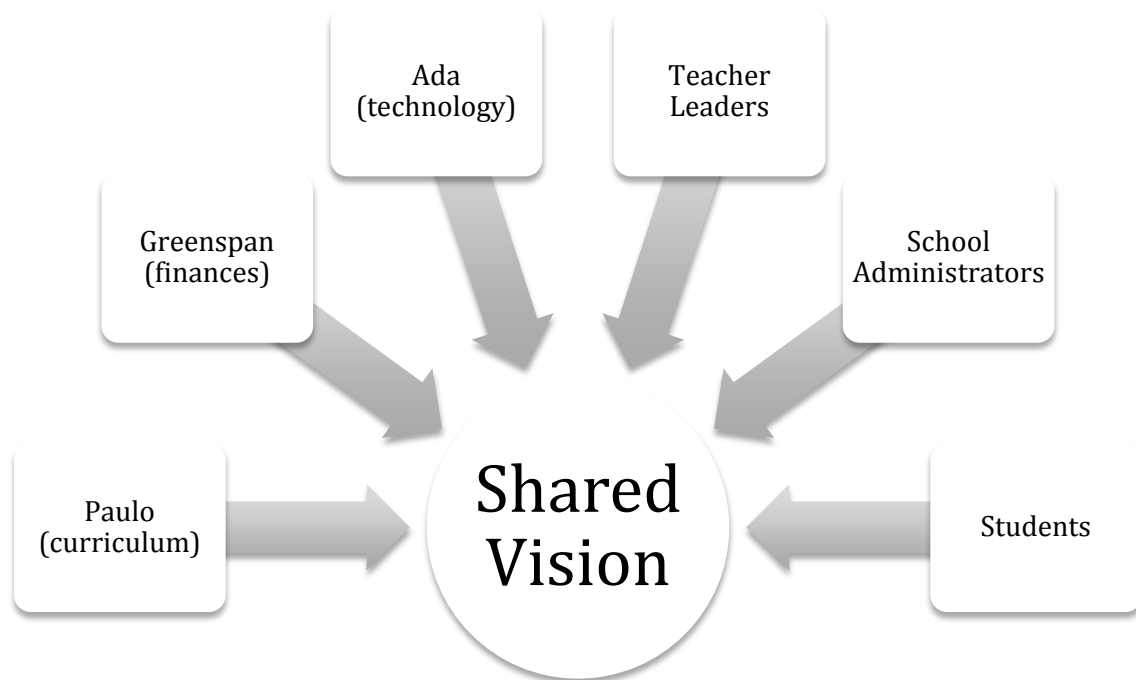

Figure 24. Shared Vision

Paulo focused on the role of technology as a means of delivering instruction. Greenspan, the finance director, contributed to the project by establishing a five and ten year financial plans to support the sustainability and growth of the project. Ada, the district technology coordinator devised a plan for hardware, software, and technological infrastructure. Ada also brought in

business partners to create a technology plan that was customized to meet the student and teacher needs at Laptop Junior High School. Greenspan, Ada, and Paulo chose teacher leaders to add to the make-up of the steering committee. Ada, Greenspan, and Paulo chose teacher leaders who were respected by their peers because of the quality of their teaching and their expertise with subject content. Ada, Paulo, and Greenspan did not choose steering committee members because of their abilities with technology. I surmised that Ada, Greenspan, and Paulo needed people who would actively question all aspects of this initiative to add credibility to the steering committee's findings. These teacher leaders would not simply be rubber stamps, but the administrators would have to win them over in order to support this costly initiative. Administrators from the high and junior high schools also were a part of the committee. The composition of the steering committee made it an effective tool in devising a shared vision for the role of technology at Laptop Junior High School. These leaders carefully researched not only the cost and identified the needs of the school but became converts for the integration of the one-to-one initiative.

The steering committee visited schools in Virginia and Texas. Their research of one-to-one laptop programs included observing and interviewing administrators, teachers, and students. The steering committee also investigated the failure of a laptop program at a large school district in Georgia. The steering committee interviewed the Georgia school administrators through a series of conference calls. The steering committee performed research on the expenses of a one-to-one laptop initiative, including framework, equipment, software, evaluation, and training. The schools in Virginia and Texas provided examples of managing the infrastructure, hardware, software, stakeholder involvement, and professional development.

It was the action research performed by the steering committee that made digital converts out of these teacher leaders. Emmy was one of the steering committee members. She told me

that witnessing the laptops in use in classrooms made a powerful impression on all of the steering committee members. I chose to identify these converted teacher leaders as digital disciples. These digital disciples returned to the fold at Laptop Junior High School with a mission to win over the hearts and minds of the teachers that the one-to-one laptop initiative was necessary in order to meet the 21st century needs of the students. Making converts of fellow teachers required the creation of a shared vision.

Action research became a tool for change at Laptop Junior High School. Figure 23 represents a timeline created from the data that represents four phases of the laptop initiative and the use of action research. Action research helped administrators to create a shared vision of what Laptop Junior High School could do if a one-to-one laptop initiative was put into place. Interviews and observations made digital disciples of teacher leaders who in turn promoted and spread the good news about laptop initiatives amongst the stakeholders. Administrators used action research in planning professional development activities. Teacher's provided feedback of each professional development activity in order to refine or adjust the following week's instruction. Continuous professional development activities over a one-year period led to a change in their combined teacher practices. Continuous professional development with teacher feedback and reflection, which set in motion a change in school culture that encouraged the teachers interviewed to embrace technology. With the laptop program in place, Ada reported to me that they began investigating other technological tools to piggyback off of the momentum of laptop initiative. Ada reported that the system had investigated both the learning management system Moodle and Apple iPads in the classroom. Curie strongly expressed a similar sentiment in wanting to investigate the usefulness of iPads in the classrooms of Laptop Junior High School.

Ada expressed to me that sustaining the forward momentum of the laptop initiative will require
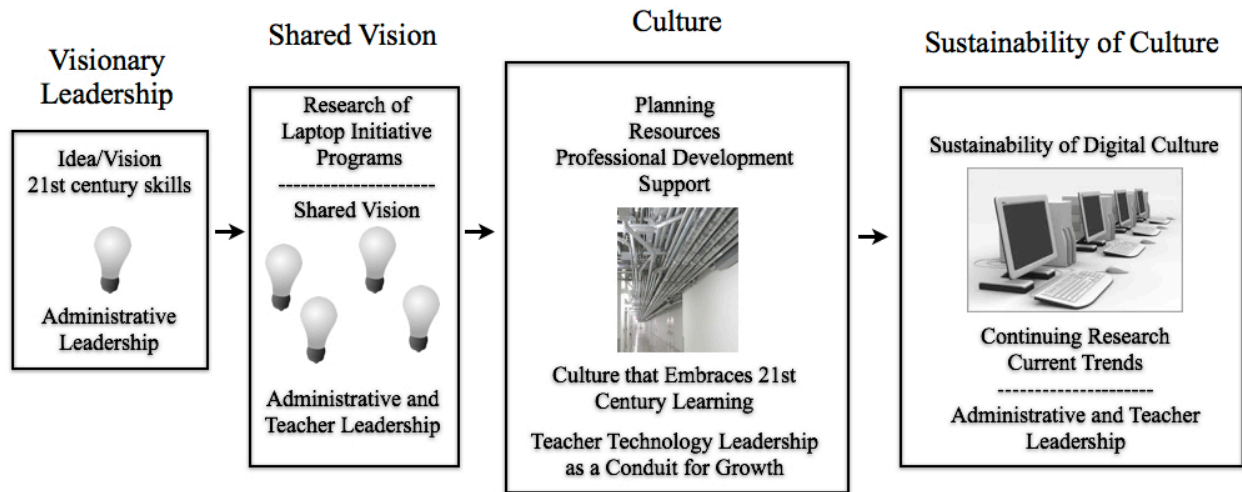
input from all stakeholders.

Figure 25. Conceptual Timeline

Finally, I concluded that leadership is occurring at three different levels within Laptop

Junior High School. Administrators served as technological leaders by supporting the

acquisition of needed resources and placing the school's shared vision for technology based

instruction at the forefront of all planning. A second or formal level of support provided by

regular professional development accompanied this. Lastly, there is a grass root or informal

movement by teacher technology leaders who provided timely support and pursued research

regarding new technologies such as classroom courseware and Apple iPads.

Important and Novel Contributions

Riel and Becker (2008) argued that teacher technology leaders could move beyond the school in sharing their expertise and experiences with others. They suggested that teacher leaders could assist in "shaping the knowledge base for learning and teaching" (p. 403). I uncovered through my analysis of teacher technology leadership at Laptop Junior High School that action research was a powerful tool for altering a school culture. I concluded that action research could serve as a meaningful component in promoting each of the four teacher technology leadership practices identified by Riel and Becker (2008):

- Teachers Learning with Technology

- Teachers Collaborating around Technology

- Teachers Networking in Technology-Active Communities

- Teachers Contributing to Knowledge About Educational Technology

Riel and Becker (2008) concluded that technological change is occurring at a rapid pace. They argued that teachers would need to use an "adaptive stance" (p. 412) in incorporating new technologies into instruction. Teachers who adopt new technological tools into their instruction need to investigate the merits of technological tools in meeting students' needs. I discovered that action research could serve as a means of investigation and reflection on the merits of technological tools. Teacher technology leaders at Laptop Junior High School used action research to investigate the merits of new tools such as Stratalogica, Moodle, and iPads in the classroom. Their findings are helping to shape the direction of technology use throughout the school.

The results of action research can be shared through both collaborative exercises and networking in technology-active communities. The teacher technology leaders at Laptop Junior High School shared their expertise, reflections, and experiences with other teachers during

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formal horizontal planning sessions and informal meetings throughout the school. They also

shared their experiences and expertise regarding the laptop initiative with other school systems

and partners such as Intel (2008a, 2008b, 2008c).

Finally, action research can serve teacher technology leaders who wish to move beyond

the confines of the classroom to add to the body of academic knowledge. Teachers can add their

research and experiences to technology literature and by participating in professional

conferences as presenters and researchers. Action research proved to be a valuable tool

throughout the integration of the laptop initiative at Laptop Junior High School. Action research

can also serve teacher technology leadership practitioners as a valuable tool for moving beyond

the confines of the classroom to assist others in incorporating technology into schools around the

world.

Practical Recommendations for Practitioners

Schools seeking to invest in a one-to-one laptop initiative need to utilize action research

as a universal tool for all aspects of the project. The steering committee employed action

research so as to create a shared vision among stakeholders. The shared vision was necessary to

solicit buy-in from all stakeholders about the role of 21st century skills across the curriculum.

Laptop Junior High School used action research to refine professional development activities.

The one-year of professional development activities, coupled with informal timely support from

teacher technology leaders has assisted in shifting the school's culture to embrace technological

change and bring 21st century skills into the classroom. Action research conducted by the

administrators and teacher technology leaders proved useful in staying current with the pulse of

technological change. The school leaders interviewed all understood that staying current with

technological trends is necessary in order to prepare students with the needed skills for life in a virtual and global marketplace.

Higher education needs to provide more technological exposure to preservice educators. Linus told me that many of the new teachers fresh out of college were behind the times when it came to experience with cutting edge technologies. In order to provide more exposure to technology, institutions of higher learning should partner with schools implementing one-to-one laptop initiatives in order to assist in providing timely support, to give preservice teachers exposure to the laptop program, and to serve as active partners to teacher researchers. When asked, only Alcibiades identified a partnership with any of the professors at a nearby university.

Recommendations for Future Research

Researchers need to investigate what teacher technology leadership looks like at other schools. Researchers also need to scrutinize the amount of technology that needs to be available in the school before teachers "become strong advocates and leaders for establishing a wider role for computers in the instructional practices of their colleagues" (Riel & Becker, 2008, p. 397).

Researchers need to further investigate the role of action research and empowerment of teachers as technology leaders at other schools. The teacher technology leaders at Laptop Junior High School had an active voice in the use of technology throughout instruction. Archimedes, Alcibiades, Emmy, and Curie all noted that when a new device or direction arose in research or conversation they directly spoke with Ada instead of passing the request through the campus technology coordinator (media specialist) or the administration. These four felt that they had an active voice in the decision making process and were experts with regards to technology usage in the classroom. Further investigation is warranted in regards to teacher ownership at Laptop Junior High School.

Researchers also need to investigate whether teacher technology leadership is influencing teachers to alter their careers and start serving as full-time IT coaches. My interview with the IT coach Linus convinced me there is a real need for teachers with curriculum and technology expertise to be a part of every school staff.

REFERENCES

AACSB International (2007). Quality issues in distance learning. Retrieved from

    http://www.aacsb.edu/publications/papers/accreditation/quality-issues-distance-

    learning.pdf

Abrams, L., & Russell, M. (2004). *Principals' beliefs about access, use, support, and obstacles*

    to technology use in schools. Boston, MA: Technology and Assessment Study

    Collaboration, Boston College.

Afshari, M., Bakar, K. A., Luan, W. S., Sanah, B. A., & Fooi, F. S. (2009). Technology and

    school leadership. *Technology, Pedagogy, and Education, 18*(2), 235–248.

Albion, P. (2008). Web 2.0 in teacher education: Two imperatives for action. *Computers in the*

    Schools, 25(4), 181–198.

Alexander, H. A. (2006). A view from somewhere: Explaining the paradigms of educational

    research. *Journal of Philosophy of Education, 40*(2), 205–221.

Alkire, G. J. (1995). Shaping your school's culture. *Trust for Educational Leadership, 24*(7).

    Retrieved from Academic Search Premier. (Accession No. 9506275899)

Allan, G. (2003). A critique of using grounded theory as a research method. *Electronic Journal*

    of Business Research Methods, 2(1), 1–10. Retrieved from

    http://www.ejbrm.com/vol2/v2-i1/issue1-art1-allan.pdf

Anderson, M. H. (2011). The world is my school: Welcome to the era of personalized learning.

    The Futurist, January–February, 12–17.

Anderson, P. (2007). What is web.2.0? Ideas, technologies, and implications for education. *JISC Technology and Standards Watch*, 1–64.

Anderson, R. E., & Dexter, S. (2005). School technology leadership: An empirical investigation of prevalence and effect. *Educational Administration Quarterly, 41*, 49–82.

Annenburg Institute for School Reform. (1998). *Reasons for hope voices for change: A report of the Annenburg Institute on public engagement for public education*. Providence, RI: Brown University.

Appleton, J. V., & King, L. (2002). Journeying from the philosophical contemplation of constructivism to the methodological pragmatics of health services research. *Journal of Advanced Nursing, 40*(6), 641–648.

Arcury, T. A., & Quandt, S. A. (1999). Participant recruitment for qualitative research: A site-based approach to community research in complex societies. *Human Organization, 58*(2), 128–133.

Askin, P., & Randewich, N. (March 15, 2012). Apple touches record high as iPad 3 sales run hot. Reuters. Retrieved from http://www.reuters.com/article/2012/03/16/apple-idUSL2E8EF98U20120316

Avolio, B., & Kohai, S. (2003). Adding the "E" to e-leadership: How it may impact your leadership. *Organizational Dynamics*, 31(4), 325–338.

Avolio, B., Kahai, S., & Dodge, G. (2000). E-leadership: Implications for theory, research, and practice. *The Leadership Quarterly, 11*(4), 615–668. doi: 10.1016/s1048-9843(00)00062-x.

Barret, V. (2010). Dropbox: Files without borders. *Forbes.com*. Retrieved from

http://www.forbes.com/forbes/2010/0628/technology-file-sharing-dropbox-google-files-

without-borders.html?boxes=Homepagechannels

Barron, A. E., Dawson, K., & Yendol- Hoppey, D. (2009). Peer coaching and technology

integration: An evaluation of the Microsoft peer coaching program. *Mentoring and*

Tutoring: Partnership in Learning, 17(1), 83-102. doi: 10.1080/13611260802658561.

Barton, M., & Cummings, R. (2008). Wiki writing: Collaborative learning in the college

classroom. Michigan: Digital Culture Books. Retrieved from

http://expertvoices.nsdl.org/highlights/2008/06/17/wikis-in-the-college-classrooms/

Bauer, J., & Kenton, J. (2005). Toward technology integration in the schools: Why it isn't

happening. *Journal of Technology and Teacher Education, 13*(4), 519–-546.

Bebell, D., & Kay, R. (2010). One to one computing: A summary of the quantitative results from

the Berkshire Wireless Learning Initiative. *Journal of Technology, Learning, and*

Assessment, 9(2). Retrieved from

http://escholarship.bc.edu/cgi/viewcontent.cgi?article=1222&context=jtla

Becker, H. J. (2000). Who's wired and who's not: Children's access to and use of computer

technology. *Children and Computer Technology, 10*(2), 44–75. Retrieved from

http://futureofchildren.org/futureofchildren/publications/docs/10.02.02.pdf

Beeland, W. D. (2002). Student engagement, visual learning, and technology: Can interactive

whiteboards help? *Action Research Exchange*. Retrieved from

http://chiron.valdosta.edu/are/Artmanscrpt/vol1no1/beeland_am.pdf

Bell, S. (2010). Project-based learning for the 21st century: Skills for the future. *The Clearing*

House, 83, 39–43. doi: 10.1080/00098650903505415

Bencich, C., Graber, E., Staben, J., & Sohn, K. (2002). Navigating in unknown waters: Proposing, collecting data, and writing a qualitative dissertation. *College Composition and Communication, 54*(2), 289–306.

Bennett, S. & Maton, K.(2010). Beyond the 'digital natives' debate: Toward a more measured understanding of students' technology experiences. *Journal of Computer Assisted Learning, 26*, 321–331. doi: 10.1111/j.1365-:2729.2010.00360.x

Berg, B. L. (2009). *Qualitative research methods for the social sciences*. Boston, MA: Allyn & Bacon.

Berners-Lee, T. (2010). Long live the web. *Scientific American*, *303*(6), 80–85.

Bernhardt, V. L. (2004). Continuous improvement: It takes more than test scores. *Leadership, 34*(2), 16–19.

Blaschke, L., & Brindley, J. (2011). Establishing a foundation for reflective practice: A case study of learning journal use. *European Journal of Open, Distance, and E-Learning (EURODL)*, *Special Issue*. Retrieved from: http://www.eurodl.org/materials/special/2011/Blaschke_Brindley.pdf

Blasé, J., & Blasé, J. (1996). Facilitative school leadership and teacher empowerment: Teachers' perspective. *Social Psychology of Education, 1*, 117–145.

Bohman, J., (2010). Critical theory. In E. N. Zalta (Ed.), *The Stanford encyclopedia of philosophy*. Retrieved from http://plato.stanford.edu/archives/spr2010/entries/critical-theory/

Bonifaz, A., & Zucker, A. A. (2004). *Lessons learned about providing laptops for all students*. Newton, MA: Education Development Center. Retrieved from http://perkinselementary.pbworks.com/f/LaptopLessonsRprt.pdf

Brinberg, D., & McGrath, J. E. (1985). *Validity and the research process*. Newbury Park, CA: Sage Publications.

Brinkerhoff, J. (2006). Effects of a long-duration, professional development academy on technology skills, computer self-efficacy, and technology integration beliefs and practices. *Journal of Research on Technology in Education, 39*, 22-43.

Brown, C. (2007). Learning through multimedia construction- A complex strategy. Journal *of Educational Multimedia and Hypermedia, 16*(2), 93–124.

Brown, T. (2011). The American and Soviet cold war space programs. *Comparative Strategy, 30*, 177–185. doi: 10.1080/01495933.2011.561736

Bruns, A., & Humphreys, S. (2005). Wikis in teaching and assessment: The M/Cyclopedia project. Retrieved from

http://snurb.info/files/Wikis%20in%20Teaching%20and%20Assessment.pdf

Brzycki, D. & Dudt, K. (2005). Overcoming barriers to technology use in teacher preparation programs. *Journal of Technology and Teacher Education, 13*(4), 619–641.

Burns, K., & Polman, J. (2006). The impact of ubiquitous computing in the Internet age: How middle school teachers integrated wireless laptops in the initial stages of implementation. *Journal of Technology and Teacher Education, 14*(2), 363–385.

Burns, K., & Polman, J. (2006). The impact of ubiquitous computing in the Internet age: How middle school teachers integrated wireless laptops in the initial stages of implementation. *Journal of Technology and Teacher Education, 14*(2), 363–385.

Carte, T. A., Chidambaram, L., & Becker, A. (2006). Emergent leadership in self-managed virtual teams. *Group Decision and Negotiation, 15*, 323–343. doi: 10l.1007/510726-006-9045-7.

Cascio, W.F., & Shurygails, S. (2002). E-leadership and virtual teams. *Organizational Dynamics, 31*(2), 362–376.

Celano, D., & Newman, S.B. (2010). Roadblocks of the information highway. *Educational Leadership, 68*(3), 50–53.

Charmaz, K. (2000). Grounded theory: Objectivist and constructivist methods. In N. K. Denzin & Y. S. Lincoln (Eds.) *Handbook of qualitative research* (pp. 509–535). Thousand Oaks, CA: Sage Publications.

Chen, C. C., Wu, J., Yang, S. C., & Tsou, H. (2008). Importance of diversified leadership roles in improving team effectiveness in a virtual collaboration learning environment. *Educational Technology & Society, 11*(1), 304–328.

Christensen, C. M., & Horn, M. B. (2008). How do we transform our schools? *Education Next, 8*(3), 1–7. Retrieved from http://www.hoover.org/publications/ednext/18575969.html

Cisco, (2008). Equipping every learner for the 21st century. Retrieved from http://www.cisco.com/web/about/citizenship/socio-economic/docs/GlobalEdWP.pdf

Clark, K. (2006). Practices for the use of technology in high schools: A Delphi study. *Journal of Technology and Teacher Education, 14*(3), 481–499.

Clifford, P., Friesen, S., & Lock, J. (2005). Coming to teaching in the 21st century: Study conducted by the Galileo network. Retrieved from http://www.galileo.org/research/publications/ctt.pdf

Cogill, J. (2002). The rise of interactive whiteboards in the primary classroom: What is effective practice and how does this relate to effective practice in teaching with ICT? Becta Research Conference 2003: *Proving Effective Practice with ICT*, TVC Congress Centre, London. Retrieved October 8, 2009, from http://www.virtuallearning.org.uk/

Cohen, P. (2005a, May 2). Apple: Cobb County deal could total 63,000 iBooks. Macworld.

Retrieved from http://www.macworld.com/article/1044584/cobb.html#lsrc.mod_rel

Cohen, P. (2005b, June 2). Lawsuit seeks to stop Cobb County iBook deal. Macworld. Retrieved

from www.macworld.com/article/1045101/cobb.html#lsrc.mod_rel

Cohen, P. (2005c, August 2). Cobb County school board kills iBook program. Macworld.

Retrieved from www.macworld.com/article/1046207/cobb.html#lsrc.mod_rel

Cohen, P. (2005d, August 24). Cobb County superintendent resigns. Macworld. Retrieved from

www.macworld.com/article/1046613/redden.html

Cole, M. (2008). Using wiki technology to support student engagement: Lessons from the

trenches. *Computers & Education, 52*(1), 141–146.

Collins, A. & Halverson, R. (2009). *Rethinking education in the age of technology: The digital

revolution and the schools.* New York: Teachers College Press.

Creswell, J. W. (2007). *Qualitative inquiry & research design: Choosing among five

approaches.* Thousand Oaks, CA: Sage Publications, Inc.

Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory Into

Practice, 39*(3), 124–130.

Cuban, L. (2001). *Oversold and underused: Reforming schools through technology, 1980-2000.*

Cambridge, MA: Harvard University Press.

Cuban, L., Kirkpatrick, H., & Peck, C. (2001). High access and low use of technologies in high

school classrooms: Explaining an apparent paradox. *American Educational Research

Journal, 38*(4), 813–834. doi: 10.3102/00028312038004813

Culp, K.M., Honey, M., & Mandinach, E. (2005). A retrospective on twenty years of educational

technology policy. *Journal of Educational Computing Research, 32*(3), 279–307.

Czarnecki, K. (2009). How digital storytelling builds 21st century skills. *Library Technology Reports, 45*(7), 15–19.

Dawson, C., & Rakes, G. C. (2003). The influence of principals' technology training on the integration of technology into schools. *Journal of Research on Technology in Education, 36*(1), 29–49.

Deboer, G. E. (2002). Student-centered teaching in a standards-based world: Finding a sensible balance. *Science & Education, 11*, 405–417.

DeGennaro, D. (2010). Opening digital doors. *Educational Leadership, 68*(3), 73–76.

Dekeyser, S., & Watson, R. (2006). *Extending Google docs to collaborate on research papers.* Technical report, The University of Southern Queensland, Australia.

Deubel, P. (2003). Learning form reflections-issues in building quality online courses. *Online Journal of Distance Learning Administration, 6*(3).

Dexter, S. (2011). School technology leadership: Artifacts in systems of practice. *Journal of School Leadership, 21*, 166–189.

Dexter, S., Doering, A. H., & Riedel, E. (2006). Content area specific technology integration: A model for educating teachers. *Journal of Technology and Teacher Education, 14*(2), 325–345.

DiMauro, L. (2009). The internet and the electronic age. *Information Plus Reference Series.* Detroit: Gale.

Donovan, L., Hartley, K., & Strudler, N. (2007). Teacher concerns during initial implementation of a one-to-one laptop initiative at the middle school level. Journal of Research on Technology in Education, 39(3), 269–283.

Dresang, E. T. (2008). Radical change: Books for youth in a digital age. *Contemporary Issues in Technology and Teacher Education, 8*(3), 277–293.

Dringus, L. P. (2000). Towards active online learning: A dramatic shift in perspective for learners. *Internet and Higher Education, 2*(4), 189–195.

Dringus, L.P. (2000). Toward active online learning: A dramatic shift in perspective for learners. *Internet and Higher Education, 2*(4), 189–195.

Dwyer, D.C., Ringstaff, C., & Sandholtz, J.H. (1991). Changes in teacher's beliefs and practices in technology-rich classrooms. *Educational Leadership, 48*(8), 45–52.

Eichenlaub, N., Gabel, L., Jakubek, D., McCarthy, G., & Wang, W. (2011). Project iPad: Investigating tablet integration in learning and libraries at Ryerson University. *Computers in Libraries*, *September*, 17–21.

en.Wikibooks.org, (2009). Henrico County Public School District laptop initiative. Retrieved from http://en.wikibooks.org/wiki/One-to-one_Laptop_Schools/Henrico

Erdogan, I., & Campbell, T. (2008). Teacher questioning and interaction patterns in classrooms facilitated with differing levels of constructivist teaching practices. *International Journal of Science Education, 30*(14), 1891–1914.

Ertmer, P. A. (1999). Addressing first- and second-order barriers to change: Strategies for technology integration. *Educational Technology Research and Development, 47*(4), 47–61. doi: 10.1007/BF02299597.

Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology, Research and Development, 53*(4), 25–40.

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How

    knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology*

    in Education, 42(3), 255–284.

Felder, R.M., & Bient, R. (1996). Navigating the bumpy road to student-centered instruction.

    College Teaching, 44, 43–47.

Ferreiro, L. D. (2008). Mahan and the "English Club" of Lima, Peru: The genesis of the

    influence of sea power upon history. *Journal of Military History, 72*(3), 901–906.

Fitzallen, N. (2005). Integrating ICT into professional practice: A case study of four mathematics

    teachers. In P.Clarkson, D. Gronn, M. Horne, A. McDonough, R. Pierce, & A. Roche

    (Eds.), *Building connections: Research, theory, and practice* – Proceedings of the 28th

    annual conference of the Mathematics Education Research Group of Australasia (pp.

    353–360). Sydney: MERGA.

Flanagan, L., & Jacobsen, M. (2003). Technology leadership for the twenty-first century

    principal. *Journal of Educational Administration, 41*(2), 124–142. doi:

    10.1108/095782303104

Floyd, D. L. (2003). Distance learning in community colleges: Leadership challenges for change

    and development. *Community College Journal of Research and Practice, 27*, 337–347.

    doi: 10.1080/10668920390128960.

Foster-Fishman, P. G., Berkowitz, S. L., Lounsbury, D. W., Jacobsen, S., & Allen, N. A. (2001).

    Building collaborative capacity in community coalitions: A review and integrative

    framework. *American Journal of Community Psychology, 29*(2), 241–261.

Franklin, C. (2007). Factors that influence elementary teacher's use of computers. *Journal of*

    Technology and Teacher Education, 15(2), 267–293.

Franklin, T., Turner, S., Kariuki, M., & Duran, M. (2001). Mentoring overcomes barriers to

 technology integration. Journal *of Computing in Teacher Education, 18*(1), 26–31.

Friere, P. (1970). *Pedagogy of the oppressed*? New York, NY: Herder and Herder.

Fullan, M. (2007). *The new meaning of educational change* (4th ed.). New York: Teachers

 College Press.

Gao, P., Wong, A. F. L., Choy, C. & Wu, J. (2010). Developing leadership potential for

 technology integration: Perspectives of three beginning teachers. *Australasian Journal of*

 *Educational Technology, 26(*5), 643–658.

Garthwait, A., & Weller, H. G. (2005). A year in the life: Two seventh grade teachers implement

 one-to-one computing. *Journal of Research on Technology in Education, 37*(4), 361–377.

Geertz, C. (1973). *The interpretation of cultures: Selected essays*. New York: Basic Books.

Girod, M., & Cavanaugh, S. (2001). Technology as an agent of change in teacher practice. *THE*

 Journal, 28(9), 40–48.

Glaser, B., & Strauss, A. (1967). *The discovery of grounded theory*. Chicago: Aldine.

Glazer, E., Hannafin, M. J., & Song, L. (2005). Promoting technology integration through

 collaborative apprenticeships. *Educational Technology Research and Development,*

 53(4), 57–67. doi: 10.1007/BF02504685.

Goodwin, B. (2011). One-to-one laptop programs are no silver bullet. *Educational Leadership*.

 Retrieved from http://www.ascd.org/publications/educational_leadership/feb11/vol68/

 num05/One-to-One_Laptop_Programs_Are_No_Silver_Bullet.aspx

Gray, L., Thomas, N., & Lewis, L. (2010). *Educational technology in U.S. public schools: Fall*

 2008 (NCES 2010). U.S. Department of Education, National Center for Education

Statistics. Washington, DC: U.S. Government Printing Office. Retrieved from

http://NCES.ed.gov/pubs1010/2010034.pdf

Greg-Bowen, J. E. (2010). *A study of technology leadership among elementary public school principals in Miami-Dade County* (Doctoral dissertation, St. Thomas University). Retrieved from http://gradworks.umi.com/3427096.pdf

Grey-Bowen, J. (2010). A study of technology leadership among elementary public school principals in Miami-Dade County. (Doctoral dissertation). WorldCat (748234922).

Guba, E. G., & Lincoln, Y.S. (2000). Competing paradigms in qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.) , *Handbook of qualitative research* (pp. 105–117). Thousand Oaks, CA: Sage Publications.

Gurr. D. (2004). ICT, leadership in education and e-leadership. *Discourse: Studies In the Cultural Politics of Education, 25*(1), 113–124.

Hall, I., & Higgins, S. (2005). Primary school students' perceptions of interactive whiteboards. *Journal of Computer Assisted Learning, 21*, 102–117.

Hamel, J., Dufour, S., & Fortin, D. (1993). *Case study methods*. Newbury Park, CA: Sage Publications.

Handley, C. M., & Kilmer, P. G. (2005). Using technology to transform communities of practice into knowledge-building communities. *ACM SIGGROUP Bulletin, 25(*1), 31–40. doi: 10.1145/1067699.1067705.

Hanna, N. (2008). Why a holistic e-development framework? *Information Technologies and International Development 4*(4), 1–7.

Hannafin, M. J., & Land, S. M. (1997). The foundations and assumptions of technology-enhanced student-centered learning environments. *Instructional Science, 25*, 167–202.

Hart, R. K., & Mcleod, P. L. (2003). Rethinking team building in geographically disguised

    teams: One message at a time. *Organizational Dynamics, 31*(4), 352–361.

Hayes, D.N.A. (2007). ICT and learning: Lessons from Australian classroom. *Computers and*

    Education, 49, 385–395. doi: 10.1016/j.compedu.2005.09.003.

Heath, H., & Cowley, S. (2004). Developing a grounded theory approach: A comparison of

    Glaser and Strauss. *International Journal of Nursing Studies, 41*, 141–150. doi:

    10.1016/S0020-7489(03)00113-5

Henig, J. R., & Hess, F. M. (2010). The declining significance of space and geography. *Phi*

    Delta Kappan, 92(3), 57–61.

Hew, K. F., & Brush, T. (2007). Integrating technology into K-12 teaching and learning: Current

    knowledge gaps and recommendations for future research. *Educational Technology*

    Research and Development, 55(3), 223–252.

Hixon, E., & Buckenmeyer, J. (2009). Revisiting technology integration in schools: Implications

    for professional development. *Computers in the Schools, 26*, 130–146. doi:

    10.1080/07380560902906070

Hoadley, C. M., & Kilner, P. G. (2005). Using technology to transform communities of practice

    into knowledge-building communities. *SIGGROUP Bulletin, 25*(1), 31–40.

Hollingsworth, L. (2011). Innovative programs. *UCEA Review, 52*(2), 10-11.

Holmes, J. R. (2011). What's the matter with Mahan? *U.S. Naval Institute Proceedings*, *137*(5),

    34–39.

Hu, W. (January 4, 2011). Math that moves: Schools embrace the iPad. The New York Times.

    Retrieved from

    http://www.nytimes.com/2011/01/05/education/05tablets.html?pagewanted=all

Hughes, J. (2005). The role of teacher knowledge and learning experiences in forming

    technology-integrated pedagogy. *Journal of Technology and Teacher Education, 13*(2),

    277–302.

Intel. (2008a). Technology as a tool for system-wide transformation: The 21st century learning

    initiative at Auburn City Schools Part 1. Preparing for change: Introduction, policy,

    leadership, and funding . Retrieved from

    http://www.k12blueprint.com/k12/blueprint/cd/Intel_Edu_Auburn_1_WP_HiRes.pdf

Intel. (2008b). Technology as a tool for system-wide transformation: The 21st century learning

    initiative at Auburn City Schools. Part 2. Enacting change: Infrastructure, professional

    development, and curriculum. Retrieved from

    http://www.k12blueprint.com/k12/blueprint/cd/Intel_Edu_Auburn_2_WP_HiRes.pdf

International Society for Technology in Education (ISTE). (2008). *National educational*

    technology standards for teachers. Retrieved from http://www.iste.org/standards/nets-

    for-teachers.aspx

International Society for Technology in Education (ISTE). (2009). *National educational*

    technology standards for administrators. Retrieved from

    http://www.iste.org/standards/nets-for-administrators.aspx

Jacobsen, D. M., & Lock, J. V. (2004). Technology and teacher education for a knowledge era:

    Mentoring for student futures, not our past. *Journal of Technology and Teacher*

    Education, 12(1), 75–101.

Jaffee, D. (2003). Virtual transformation: Web-based technology and pedagogical change.

    Teaching Sociology. Retrieved from http://www.unt.edu/ndjaffee/virtualtran.htm

Jamali, H. R., & Asadi, S. (2009). Google and the scholar: The role of Google in scientists'
information-seeking behavior. *Online Information Review, 34*(2), 282–294.

Jensen, D. F. N. (2006). Metaphors as a bridge to understanding educational and social contexts.
International Journal of Qualitative Methods, 5(1), 1–17. Retrieved from
http://www.ualberta.ca/~iiqm/backissues/5_1/pdf/jensen.pdf

Jensen, J. L., & Rodgers, R. (2001). Cumulating the intellectual gold of case study research.
Public Administration Review, 61(2), 235–246.

Joyce, B. & Showers, B. (1980). Improving inservice training: The message of research.
Educational Leadership, 37(5), 379–385.

Judson, E. (2006). How teachers integrate technology and their beliefs about learning: Is there a
connection? *Journal of Technology and Teacher Education, 14*, 581–597.

Jukes, I., McCain, T., & Crockett, L. (2010). Education and the role of the educator in the future.
Phi Delta Kappan, 92(4), 15–21.

Kagan, D. (1992). Professional growth among preservice and beginning teachers. *Review of
Educational Research, 62*, 129–169.

Katyal, K. (2010). Educating teachers in Hong Kong for leadership in the age of the Internet: A
re-conceptualisation. *Asia-Pacific Journal of Teacher Education, 38*(4), 273–284.

Kayworth, T. R., & Leidner, D. E. (2002). Leadership effectiveness in global virtual teams.
Journal of Management Information Systems, 18(3), 7–40.

Keengwe, J., Schnellert, G., & Mills, C. (2011). Laptop initiative: Impact on instructional
technology integration and student learning. *Education and Information Technologies,
17*(2), 137–146.

Kelly, B. C. (2010). Sampling and recruitment issues in qualitative drug research. Reflections on the study of club drug users in metro New York. *Substance Use & Misuse, 45*, 671–683. doi: 10.3109/10826081003594799.

Kennewell, S., Tanner, H., Jones, S., & Beauchamp, G. (2007). Analyzing the use of interactive technology to implement interactive teaching. *Journal of Computer Assisted Learning, 24*(1), 61–73.

Kerawalla, L., Minocha, S., Kirkup, G., & Conole, G. (2008). Characterizing the different blogging behaviors of students on an online distance learning course. *Learning Media and Technology, 33*(1), 21–33.

King, R. (2007). Wikis make deep inroads into corporations. *Bloomberg Businessweek*. Retrieved from http://www.msnbs.msn.com/id/17582825/

Klobas, J. (2006). *Wikis: Tools for information work and collaboration*. Oxford: Chandos.

Knowlton, D. S. (2000). A theoretical framework for the online classroom: A defense and delineation of a student-centered pedagogy. *New Directions for Teaching and Learning, 84,* 5–14.

Koch, T. (1998). Reconceptualizing rigour: The case for reflexivity. *Journal of Advanced Nursing, 28*(4), 882–890.

Kochan, F. K., & Trimble, S. B. (2000). From mentoring to co-mentoring: Establishing collaborative relationships. *Theory Into Practice, 39*(1), 20–28.

Kopcha, T. J. (2008). A systems-based approach to technology integration using mentoring and communities of practice. *Educational Technology Research and Development, 58*(2), 175–190. doi: 10.1007/s11423-008-9095-4.

Kuhn, T. (1962). *The structure of scientific revolutions*. Chicago, IL: University of Chicago
Press.

Kvale, S., & Brinkmann, S. (2009). *InterViews: Learning the craft of qualitative research
interviewing.* Thousand Oaks, CA: Sage Publications.

Lane, C., & Lyle, H. (2009). The differing technology support needs of beginner and expert
users: Survey findings from the University of Washington. In *Proceedings of World
Conference on Educational Multimedia, Hypermedia and Telecommunications 2009* (pp.
2431–2436). Chesapeake, VA: AACE.

Larson, L., Miller, T., & Ribble, M. (2009). Five considerations for digital age leaders: What
principals and district administrators need to know about tech integration today. *Learning
and Leading with Technology, 37*(4), 12–15.

Lather, P. (1986). Issues of validity in openly ideological research: Between a rock and a soft
place. *Interchange, 17*(4), 63–84.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. New
York: Cambridge University Press.

Lazo, L. (2011, February 24). Henrico schools to pursue tablets. *Richmond Times-Dispatch*.
Retrieved from http://www2.timesdispatch.com/news/news/2011/feb/24/tdmain01-
henrico-schools-to-pursue-tablets-ar-863677/

Leh, A. (2005). Lessons learned from service learning and reverse mentoring in faculty
development: A case study in technology training. *Journal of Technology and Teacher
and Teacher Education, 13*(1), 25–41.

Lei, J., & Zhao, Y. (2008). One-to-one computing: What does it bring to schools? *Journal of
Educational Computing Research, 39*(2), 97–122.

Lei, J., & Zhao, Y. (2009). Technology uses and student achievement: A longitudinal study. *Computers and Education, 49*, 284–296.

Leithwood, K., Leonard, L., & Sharratt, L. (1998).Conditions fostering organizational learning in schools. *Educational Administration Quarterly*, *34*(2), 243–276.

Leithwood, K., Patten, S., & Jantzi, D. (2010). Testing a conception of how school leadership influences student learning. *Educational Administration Quarterly, 46*(5), 671–706. doi: 10.1177/0013161x10377347.

Leonard, L. J., & Leonard, P. E. (2006). Leadership for technology integration: Computing the reality. *The Alberta Journal of Educational Research, 52*(4), 212–224.

Levin, T., & Wadmany, R. (2008). Teachers' views on factors affecting effective integration of information technology in the classroom: Developmental scenery. *Journal of Technology and Teacher Education, 16*(2), 233–263.

Levy, D., & Scully, M. (2007). The institutional entrepreneur as modern prince: The strategic force of power in contested fields. *Organizational Studies, 28* (7), 971–991. doi: 10.1177/017084067078109.

Lewin, K. (1946) Action research and minority problems. *Journal of Social Issues 2*(4), 34–46.

Li, S. C. (2009). Social capital, empowerment and educational change: A scenario of permeation of one-to-one technology in school. *Journal of Computer Assisted Learning, 26*, 284–295.

Lieberman, A., & Mace, D. P. (2010). Making practice public: Teacher learning in the 21st century. *Journal of Teacher Education, 61*, 77–88. doi: 10.1177/0022487109347319.

Lightfoot, J. M. (2005). Integrating emerging technologies into traditional classrooms: A pedagogic approach. *International Journal of Instructional Media, 32*(3), 209–225.

Lim, C. P., & Khine, M. (2006). Managing teachers' barriers to ICT integration in Singapore schools. *Journal of Technology and Teacher Education, 14*(1), 97–125.

Lincoln, Y. S., & Guba, E. G. (1985) *Naturalistic inquiry*. Newbury Park, CA: Sage Publications.

Little, P. F. B. (2005). Peer coaching as a support to collaborative teaching. *Mentoring and tutoring: Partnership in Learning, 13*(1), 83–94. doi: 10.1080/136112605000 40351.

Liu, G. Z. (2010). Spontaneous group decision making in distributed collaborative learning: Toward a new research direction. *Journal of Online Learning and Teaching, 6*(1). 1–15. Retrieved from http://jolt.merlot.org/vol6no1/liu_0310.htm

Love, J., & Wenger, E. (1991). Situated *learning: Legitimate peripheral participation*. New York: Cambridge University Press.

Luthra, S., & Fochtman, P. (2011). The road to lasting tech leadership. Learning & Leading with Technology, May, 16–23.

Macaulay, L. S. (2009). *Elementary principals as technology instructional leaders*. (Unpublished doctoral dissertation) Towson University, Towson, Maryland.

Machin, S., McNally, S., & Silva, O. (2007). New technology in the schools: Is there a payoff? *The Economic Journal, 117*(522), 1145–1167. doi: 10.1111/j.1468-0397.2007,02070.x.

MacQueen, K. M., McLellan, E., Kay, K., & Milstein, B. (1998). Codebook development for team-based qualitative analysis. *Cultural Anthropology Methods, 10*(2), 31–36.

Manning, R. D., Cohen, M. S., & DeMichiell, R. L. (2003). Distance learning: Step by step. *Journal of Information Technology Education, 2*, 115–130.

Marks, H. M., & Printy, S.M. (2003). Principal leadership and school performance: An integration of transformational and instructional leadership. *Educational Administration Quarterly, 39*(3), 370–397. doi: 10.1177/0013161x03253412.

Marmarelli, T., & Ringle, M. (2011). *The Reed College iPad study*. Portland, OR: Reed College.

Marx, G. (2006). *Future-focused leadership: Preparing schools, students, and communities for tomorrow's realities*. Alexandria, VA: ASCO.

Mahan, A. T. (1890) *The influence of sea power upon history, 1680–1783*. New York: Little, Brown & Co.

Maxwell, J. A. (1992). Understanding and validity in qualitative research. *Harvard Educational Review, 62*(3), 279–300.

McAfee, A.P. (2006). Enterprise 2.0: The dawn of emergent collaboration. *Sloan Management Review, 47*(3), 21–28. Retrieved from http://sloanreview.mit.edu/ the-magazine/articles/2006/spring/47306/enterprise-the-dawn-of-emergent-collaboration/

McClanahan, B., Williams, K., & Kennedy, E. (2012). A breakthrough for Josh: How use of an iPad facilitated reading improvement. *TechTrends, 56*(3), 20–28. doi: 10.1007/s11528-012-0572-6.

McKenzie, J. (2002. Leading by example: The high tough high tech principal. *From Now On: The Educational Technology Journal, 11*(10). Retrieved from http://www.tno.ort/sum02/principal.html

McLeod, S. (2011). Are we irrelevant to the digital, global world in which we now live? *UCEA Review, 52*(2), 1–5. Retrieved from http://www.ucea.org/storage/review/Summer2011Review_lowres.pdf

McLeod, S., & Richardson, J. W. (2011). The dearth of technology leadership coverage. *Journal of School Leadership*, 21, 216–240.

McLester, S. (2011). Establishing a technological culture. *District Administration*. Retrieved from http://www.districtadministration.com/article/establishing-technological-culture

Menchaca, M. P., & Bekele, T. A. (2008). Learner and instructor identified success factors in distance education. *Distance Education, 29*(3), 231–252.

Mentz, E., & Mentz, K. (2003). Managing technology integration into schools: A South African perspective. *Journal of Educational Administration, 41*(2), 186–200.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook.* Thousand Oaks, CA: Sage Publications.

Mills, S. C., & Tincher, R. C. (2003). Be the technology: A developmental model for evaluating technology integration. *Journal of Research on Technology in Education, 35*(3), 382–401.

Moghaddam, A. (2006). Coding issues in grounded theory. *Issues in Educational Research, 16*(1), 52–66. Retrieved from http://www.iier.org.au/iier16/moghaddam.html

Moodle. (2010). Retrieved from http://docs.moodle.org/en/Background

Moyle, K., & Webb, I. (2006). E-leadership-More than just good leadership. Paper presented at the Australian Computers in Education Conference, Cairns.

Munch, R. (1990). Differentiation, rationalization, interpretation: The emergence of modern society. In J. C. Alexander & P. Colomy (Eds.) *Differentiation theory and social change: Comparative and historical perspectives* (p. 477). New York, NY: Columbia University Press.

Murray, O. T., & Olcese, N. R. (2011). Teaching and learning with iPads, ready or not?

    TechTrends, 55(6), 42–48.

National Mathematics Advisory Panel. (2008). *Foundations for success: The final report of the*

    National Mathematics Advisory Panel. Washington, DC: U.S. Department of Education.

National Telecommunications and Information Administration. (2000). *Falling through the net:*

    Toward digital inclusion. Washington, DC: National Telecommunication and

    Information Administration. Retrieved from

    http://www.ntia.doc.gov/ntiahome/fttn00/contents00.html

Niaz, M. (2009). Qualitative methodology and its pitfalls in educational research. *Quality &*

    Quantity, 43(4), 535–551. doi: 10.1007/s11135-007-9136-9

Norris, C., Sullivan, T., Poirot, J., &Soloway, E. (2003). No access, no use, no impact: Snapshot

    surveys of educational technology in K–12. *Journal of Research on Technology in*

    *Education, 36(*1), 15–27.

Norton, J. (2007). Schools must bridge the digital divide: Every student needs 21st century skills.

    Working Towards Excellence: The Journal of the Alabama Best Practices Center, 6(2),

    10–15. Retrieved from http://www.abpc21.org/digitaldivide.html

Norum, K. E., Grabinger, R. S., & Duffield, J. A. (1999). Healing the universe is an inside job:

    Teachers' views on integrating technology. *Journal of Technology and Teacher*

    Education, 7(3), 187–203. Retrieved from http://editlib.org/p/8978

O'Neil, D. V. (2003). The role of institutional motivations in technological adoption:

    Implementation of DeKalb County's family technology resource centers, *Information*

    Society, 19(4), 305–315.

Okojie, M., Olinzock, A., & Okojie-Boulder, T. (2006). The pedagogy of technology integration. *The Journal of Technology Studies, 32*, 66–71.

Orlikowski, W. J. (1992). The duality of technology: Rethinking the concept of technology in organizations. *Organization Science, 3*, 398–427.

Orlikowski, W. J. (1996). Improvising organizational transformation over time: *A situation change perspective. Information Systems Research, 7*, 63–92.

Orrill, C. H. (2001). Building learner-centered classrooms: A professional development framework for supporting critical thinking. *Educational Technology Research and Development, 49*(1), 15–34.

Ottenbreit-Leffwich, A. T., Glazewski, K. D., Newby, T. J., & Ertmer, P. A. (2010). Teacher value beliefs associated with using technology: Addressing professional and student needs. *Computers & Education, 55*, 1321–1335. doi: 10.1016/ j.compedu.2010.06.002

Pappas, M., (2009). Inquiry and 21st century learning. *School Library Media Activities Monthly, 25*(9), 49–51.

Parker, M. (2011). Managing space, organizing the sublime. Studies in Space Policy, 5(1), 28–38. doi: 10.1007/978-3-7091-0280-0_3

Partnership for 21st Century Skills. (2012). Framework for 21st century learning. Retrieved from http://www.p21.org/storage/documents/1.__p21_framework_2-pager.pdf

Penuel, W. R. (2006). Implementation and effects of one-to-one computing initiatives: A research synthesis. *Journal of Research on Technology in Education, 38*(3), 329–348.

Perez, S. (2009). For NASA employees, it's "Spacebook" not Facebook. *Read Write Enterprise*. Retrieved from http://www.readwriteweb.com/enterprise/2009/06/for- nasa-employees-its-spacebook-not-facebook.php

Peshkin, A. (1993). The goodness of qualitative research. *Educational Researcher, 22*(2), 23–29.

Piaget, J. (1973). *To understand is to invent.* New York: Grossman.

Pianfetti, E. S. (2001). Teachers and technology: Digital literacy through professional

    development. *Language Arts, 78*(3), 255–262.

Poirier, R. (2009). *Exploring the intersections of social class, identity, and self-regulation during*

    the transition from high school to college. (Doctoral dissertation). Retrieved from

    OhioLINK ETD Center (osu1231209611).

Popper, K. R. (1959) *The logic of scientific discovery*. New York, NY: Routledge.

Porter, S. (2007). Validity, trustworthiness and rigour: Reasserting realism in qualitative

    research. *Journal of Advanced Nursing, 60*(1), 79–86. doi: 10.1111/j.1365-

    2648.2007.04360.x.

Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon, 9*(5). 1–6.

Prensky, M. (2007). Listen to the natives. *Educational Leadership, 63*(4). 8–13.

Prensky, M. (2009). H.Sapiens digital: From digital immigrants and digital natives to digital

    wisdom. *Innovate, 5*(3). Retrieved from

    http://www.annenberginstitute.org/pdf/Crusade.pdf

Prensky, M (2010). The iPad is coming! (or is it?) *Educational Technology*. Retrieved from

    http://www.marcprensky.com/writing/Prensky-TheiPadIsComing-orIsIt-EdTech2010-

    02.pdf

Pulley, M. L., McCarthy, J., & Taylor, S. (2000). E-leadership in the networked economy.

    Leadership in Action, 20(3), 1–7.

Reimers-Hild, C., & King, J.W. (2009). Six questions for entrepreneurial leadership and

    innovation in distance education. *Online Journal of Distance Learning Administration,*

12(4), 1–8. Retrieved from http://www.westga.edu/~distance /ojdla/winter124/reimers-hild124.html

Richardson, J. W., & McLeod, S. (2011). Technology leadership in Native American schools. *Journal of Research in Rural Education, 26*(7).Retrieved from http://jrre.psu.edu/articles/26-7.pdf.

Riel, M., & Becker, H. J. (2008). Characteristics of teacher leaders for information and communication technology. In J. Voogt & G. Knezek (Eds.), *International handbook of information technology in primary and secondary education* (pp. 397–417). New York, NY: Springer International Handbooks of Education. doi: 10.1007/978-0-387-73315-9_24.

Roberts, J. (2006). Limits to communities of practice. *Journal of Management Studies, 43*(3), 623–639. doi:10.1111/j.1467-6486.2006.00618x

Rochelle, J., Pea, R., Hoodly, C., Gordin, D., & Means, B. (2001). Changing how and what children learn in school with computer-based technologies. *The Future of Children, 10*(2), 76–101. doi: 10.2307/1602690.

Roe, M. (2011). Learning tools for innovation: The right technology tools can build capacity in students and teachers while promoting innovative thinking and problem solving. *Leadership, 40*(4), 32–36.

Rogers, P. L. (1999). *Barriers to adopting emerging technologies in education*. Richmond, VA: Virginia Commonwealth University.

Russell, M., Bebell, D., & Higgins, J. (2004). *Laptop learning: A comparison of teaching and learning in upper elementary classrooms equipped with shared carts of laptops and*

permanent one-to-one laptops. Boston: Technology and Assessment Study Collaborative, Boston College.

Rutkowski, D., Rutkowski, L., & Sparks, J. (2011). Information and communications technologies support teaching: An international analysis. *Journal of School Leadership, 21*(2), 190–215.

Sagor, R. (2009). Collaborative action research and school improvement: We can't have one without the other. *Journal of Curriculum and Instruction, 3*(1), 7–14. doi:10.3776/joci.2009.v3n1. Retrieved from http://www.joci.ecu.edu

Sanchez, J. (2009). Barriers to student learning is Second Life. *Library Technology Reports, 45*(2), 29–34.

Schiller, J. (2003). Working with ICT perceptions of Australian principals. *Journal of Educational Administration, 41*(2), 171–185.

Schrum, L., Galizio, L. M., & Ledesma, P. (2011). Educational leadership and technology integration: An investigation into preparation, experiences, and roles. *Journal of School Leadership Journal of School Leadership, 21*, 241–261.

Schwab, R. L., & Foa, L. J. (2001). Integrating technologies throughout our schools. *Phi Delta Kappan, 82(*8), 620–624.

Schwandt, T. A. (2000). Three epistemological stances for qualitative inquiry: Interpretivism, hermeneutics, and social constructionism. In N.K. Denzin & Y.S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 189-213). Thousand Oaks, CA: Sage Publications.

Schwandt, T. A. (2007). *The Sage dictionary of qualitative inquiry.* Thousand Oaks, CA: Sage Publications.

Selfe, C. L. (2000). *Technology and literacy in the twenty-first century*. Carbondale, IL: Southern

    Illinois University Press.

Senge, P., Kleiner, A., Roberts, C., Ross, R. B., & Smith, B. (1994). *The fifth discipline field*

    book: Strategies and tools for building a learning organization. New York, NY:

    Currency.

Senge, P., Earnbron-McCabe, N., Lucas, T., Smith, B., Dutton, J., & Kleiner, A. (2000). *Schools*

    that learn: A fifth discipline field book. New York, NY: Doubleday.

Senge, P. M. (1990). *The fifth discipline. The art and practice of the learning organization.*

    London, England: Random House.

Sheingold, K., & Hadley, M. (1990). Accomplished teachers: Integrating computers into

    classroom practice. *Center for Technology in Education*, 1–26.

Sherry, L., & Gibson, D. (2002). The path to teacher leadership in educational technology.

    Contemporary Issues in Technology and Teacher Education, 2(2), 178–203.

Short, P. M. (1994). Defining teacher empowerment. *Education, 114*(4), 488–493.

Showers, B., & Joyce, B (1996). The evolution of peer coaching. *Educational Leadership, 53*(6),

    12–16.

Silva, E. (2009, May). Measuring skills for 21st-century learning. *Phi Delta Kappan*, *90*(9), 630.

Silverman, D. (1993). *Interpreting qualitative data: Methods for analyzing talk, text, and*

    interaction. Thousand Oaks, CA: Sage Publications.

Silvernail, D. L., (2011). A middle school one-to-one laptop program: The Maine experience.

    Gorham, ME: Maine Educational Policy Research Institute, University of Southern

    Maine.

Silvernail, D., & Gritter, A. (2007). Maine's middle school laptop program: Creating better

writers. Gorham, ME: *Maine Educational Policy Research Institute*, University of

Southern Maine.

Sime, D., & Priestley, M. (2005). Student teachers' first reflections on information and

communication's technology and classroom learning: Implications for initial teacher

education. *Journal of Computer Assisted Learning, 21*(2), 130–142.

Simmons, W. (2005). Community engagement and education reform: Making the case.

Presentation presented at the Providence Educational Excellence Coalition, Annenberg

Institute for School Reform. PowerPoint retrieved from

http://www.annenberginstitute.org/pdf/Crusade.pdf

Smith, H. J., Higgins, S., Wall, K., & Miller, J. (2005). Interactive whiteboards: Boon or

bandwagon? A critical review of the literature. *Journal of Computer Assisted Learning,

21*(2), 91–101.

Somech, A. (2005). Directive versus participative leadership: Two complementary approaches to

managing school effectiveness. *Educational Administration Quarterly, 41*(5), 777–800.

Spanbauer, S. (2007). Comparing collaborative web services. *PCWorld*. Retrieved from

http://www.pcworld.com/businesscenter/article/138697/comparing_collaborative_web_se

rvices.html

Stake, R, E. (1995) *The Art of Case Study Research*. London: Sage.

Stake, R. E. (2000). Case studies. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of

qualitative research* (pp. 435–453). Thousand Oaks, CA: Sage Publications.

Stake, R. E., & Trumbull, D. J. (1982). Naturalistic generalizations. *Review Journal of

Philosophy and Social Science, 7*, 3–12.

Stanek, M.B. (2001). Global mentoring programs: Business relationships beyond traditional borders. *Journal of Workplace Learning, 13*(2), 66–72.

Staples, A., Pugach, M. C., & Himes, D. (2005). Rethinking the technology integration challenge: Cases from three urban elementary schools. *Journal from Research on Technology in Education, 37*(3), 285–311.

Starkey, L. (2010). Supporting the digitally able beginning teacher. *Teaching and Teacher Education, 26*(7), 1429–1438. doi: 10.1016/j.tate2010.05.002.

Strauss, A. (1987). *Qualitative analysis for social scientists*. New York, NY: Cambridge University Press.

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques.* Newbury Park, CA: Sage Publications.

Strom, P. S., & Strom, R. D. (2009). *Adolescents in the Internet age*. North Carolina: Information Age Publishing.

Sugar, W., & Holloman, H. (2009). Technology leaders wanted: Acknowledging the leadership role of a technology coordinator. *TechTrends, 53*(6), 66–75. doi: 10.1007/s11528-009-0346-y.

Sun, J. (2000). *Planning into practice*. Durham, NC: SEIRTEC. Retrieved from http://www.seirtec.org/P2P.html

Sun, J., Flores, J., & Tanguma, J. (2012). E-textbooks and students' learning experiences. *Decision Sciences Journal of Innovative Education, 10*(1), 63–77.

Tan, S. C., Seah, L. H., Yeo, J. & Hung, D. (2008). Online learning communities in k–12 settings. In J. Voogt & G. Knezek (Eds.), *International handbook of information technology in primary and secondary education*. New York: Springer.

Tellis, W. (1997). Introduction to case study. The Qualitative Report, 3(2). Retrieved from

    http://www.nova.edu/ssss/QR/QR3-2/tellis1.html

Thomas, D. H (2008). The digital divide: What schools in low socioeconomic areas must teach.

    Delta Kappa Gamma Bulletin, 74(4), 12–17.

Thomas, G., & James, D. (2006) Reinventing grounded theory: Some questions about theory,

    ground and discovery. *British Educational Research Journal, 32*(6), 767–795. doi:

    10.1080/01411920600989412.

Thomas, L. G., & Knezek, D. (1991). Providing technology leadership for restructured schools.

    Journal of Research on Computing in Education, 24(2), 265–280.

Thomas. L. G., & Knezek, D. (2008). Information, communications, and educational technology

    standards for students, teachers, and school leaders. In J. Voogt & G. Knezek (Eds.),

    International handbook of information technology in primary and secondary education.

    New York: Springer.

Thornton, B. (2011). Personal technology in the classroom. eLearn, 4(2). doi:

    10.1145/1999647.1999649. Retrieved from

    http://elearnmag.acm.org/archive.cfm?aid=1999649

Toomey, R. (2001). Information and communication technology for teaching and learning.

    Schooling Issues Digest 2. Canberra: Department of Education, Training and Youth

    Affairs. Retrieved from http://www.dest.gov.au/NR/rdonlyres/C251724A-1E09-4954-

    BFBE-FDA5836375E3/4508/technology.pdf

Trimmel, M., & Bachmann, J. (2004). Cognitive, social, motivational and health aspects of

    students in laptop classrooms. *Journal of Computer Assisted Learning, 20*(2), 151–158.

Trist, E. L. (1981). *The evolution of socio-technical systems: A conceptual framework and an action research program.* Paper presented at the Conference on Organizational Design and Performance, Centre for the Study of Organizational Innovation, Toronto: Ontario.

Trochim, W. (2006) Pattern matching for construct validity. *Research Methods Knowledge Base.* Retrieved from http://www.socialresearchmethods.net/kb/pmconval.php

U.S. Department of Education, Office of the Under Secretary, Policy and Program Studies Service. (2003). *Federal funding for educational technology*. Washington, DC. Retrieved from http://www2.ed.gov/rschstat/evaL/tech/iset/summary2003.doc

Van Maanen, J. (1988). *Tales of the field: On writing ethnography*. Chicago: University of Chicago Press.

Van Melle, E., & Cimellaro, L. (2003). A dynamic framework to guide the implementation and evaluation of educational technologies. *Education and Information Technologies, 8*(3). 267–285.

Vanetta, R. A., & Fordham, N. (2004). Teacher dispositions as predictors of classroom technology use. *Journal of Research on Technology in Education, 36*(3), 253–271.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Cambridge, MA: Harvard University Press.

Waldron, N. L., & Mcleskey, J. (2010). Establishing a collaborative school culture through comprehensive school reform. *Journal of Educational and Psychological Consultation, 20*(1), 58–74. doi: 10.1080/10474410903535364.

Walvoord, A. A. G., Redden, E. R., Elliot, L.R., & Coovert, M. D. (2008). Empowering followers in virtual teams: Guiding principles from theory and practice. *Computers in Human Behavior, 24*, 1884–1906. doi: 10.106/J.chb.2008.02.006.

Ward, L. (2003). Teacher practice and the integration of ICT: Why aren't our secondary schools' teachers using computers in their classrooms? Retrieved from www.google.com.au/search?client=safari&rLs+en&q=Lorrae+Ward&ie=UTF-8&oe=UTF-8&redir_esc=&ei=Xsa6S-T_D4Ge6gP:8rXbBQ

Warren, M. R. (2005). Communities and schools: A new view of urban education reform. *Harvard Educational Review, 7*5, 133–173.

Watson, J. (2009). Keeping pace with K–12 online learning. *Evergreen Education Group*. Retrieved from http://www.kpk12.com/

Weber, E. G. (2009). Middle schools, one-to-one. *Principal Leadership, 10*(4), 27–31. Retrieved from http://www.nassp.org/portals/0/content/61071.pdf

Wells, J., & Lewis, L. (2006). Internet access in US public schools and classrooms: 1994-2005 (NCES 2007-2020). *US Department of Education*. Washington, DC: National Center for Education Statistics.

Wenger, E. (1998). Communities of practice: Learning as a social system. *Systems Thinker*. Retrieved from http://www.co-i-l.com/coil/knowledge-garden/cop/lss.shtml

Wenger, E., White, N., & Smith, J. D. (2009). *Digital habitats: Stewarding technology for communities*. Portland, OR: CPsquare. Retrieved from https://tenniscafe.com/documents/590/digitalhabitatsactionnotebook.pdf

Wenger, E. C., & Snyder, W. M. (2000). Communities of practice: The organizational frontier. *Harvard Business Review, 78*(1), 139–145.

Weston, M. E., & Bain, A. (2010). The end of techno-critique: The naked truth about 1:1 laptop initiatives and educational change. *Journal of Technology, Learning, and Assessment, 9*(6). Retrieved from http://www.jtla.org

Wheatley, K. F. (2004). Increasing computer use in early childhood teacher education: The case

    of a "computer muddler." *Information Technology in Childhood Education Annual, 2*(4),

    510–532. doi: 10.1.1.117.8740.

Wheatley, M. J. (1999). *Leadership and the new science: Discovering order in a chaotic world*.

    San Francisco, CA: Bennett-Koehler.

Whitehead, B. M., Jensen, D. F. N., & Boschee, F. (2003). *Planning for technology: A guide for*

    school administrators, technology coordinators, and curriculum leaders. Newbury Park,

    CA: Corwin Press.

Williams, S. M. (2009). Technology and community-centered learning. Retrieved from

    http://citesecrx.ist.psu.edu/viewdoc/download?doi=10.1.1.137.6111&rep=rep1&type=pdf

Willmore, D., & Betz, M. (2000). Information technology and schools: The principal's role.

    Educational Technology and Society. Retrieved from

    http://ifets.ieee.org/periodical/vol_4_2000/v_4_2000.html105

Windschitl, M., & Sahl, K. (2002). Tracing teachers' use of technology in a laptop computer

    school: The interplay of teacher beliefs, social dynamics, and institutional culture.

    American Educational Research Journal, 39(1), 165–205.

Wong, E. M. L., & Li, S. C. (2008). Framing ICT implementation in a context of educational

    change: A multilevel analysis. *School Effectiveness and School Improvement, 19*(1), 99–

    120. doi: 10.1080/09243450801896809.

Wood, R., & Ashfield, J. (2008). The use of the interactive whiteboard for creative teaching and

    learning in literary and mathematics: A case study. *British Journal of Educational*

    Technology, 39(1), 84–96.

Wozney, L., Venkatesh, V., & Abrami, P. C. (2006). Implementing computer technologies: Teachers' perceptions and practices. *Journal of Technology and Teacher Education, 14*, 173–207.

Wright, V. H., & Wilson, E. K. (2006). From preservice to inservice teaching: A study of technology integration. *Journal of Computing in Teacher Education. 22*(2), 49–55.

Yee, D. L. (2000). Images of school principals' information and communications technology leadership. *Journal of information Technology for Teacher Education, 9*(3), 287–302.

Yin, R. K. (1994). *Case study research: Designs and methods*. Thousand Oaks, CA: Sage Publications.

Yuen, A. H. K., Law, N., & Wong, K.C. (2003). ICT implementation and school leadership: Case studies of ICT integration in teaching and learning. *Journal of Educational Administration, 41*(2), 158–170.

Yuen, H. K., Lee, M. W., & Law, N. (2009). School leadership and teachers' pedagogical orientations in Hong Kong: A comparative perspective. *Education and Information Technologies*, 14(4), 381–396.

Zevenberger, R., & Lerman, S. (2008). Learning environments using interactive whiteboards: New learning spaces or reproduction of old technologies? *Mathematics Education Research Journal, 20*(1), 107–125.

Zhang, S., Fermestad, J., & Tremaine, M. (2005, January). *Leadership styles in virtual team context. Limitations, solutions, and propositions.* Paper presented at the 38th Annual Hawaii International Conference of System Sciences. doi: http://doi.ieeecomputersociety.org/10.1109/HICSS.2005.382.

Zhao, Y, Pugh, K., Sheldon, S., & Byers, J. (2002). Conditions for classroom technology innovations. *Teachers' College Record, 10(*4), 482–515.

Zhao, Y., & Frank, K. A. (2003). Factors affecting technology uses in schools: An ecological perspective. *American Educational Research Journal, 40*, 807–840.

Ziegler, B. (1992, May 29). Digital doorway opens onto revolutionary world. *Chicago Sun-Times.*

Zigurs, I. (2003). Leadership in virtual teams: Oxymoron or opportunity? *Organizational Dynamics. 31*(4), 339–351.

Zimmerman, M. A., Israel, B. A., Schulz, A., & Checkoway, B. (1992). Further explorations in empowerment theory: An empirical analysis of psychological empowerment. *American Journal of Community Psychology, 20*(6), 707–728.

Zucker, A., & McGhee, R. (Eds.). (2005). A study of one-to-one computer use in mathematics and science instruction at the secondary level in Henrico county public schools. *SRI International*.

Appendix 1

Superintendent Approval to Conduct Study

August 25, 2011

Mrs. Cristen Herring
Assistant Superintendent
Auburn City Schools
855 E. Samford Avenue
Auburn, AL 36830

Dear Mrs. Herring:

I am a doctoral candidate in the Educational Foundations, Leadership and Technology department at
Auburn University and a media specialist/technologist with the Enterprise City Schools. I am interested in
researching teachers as technology leaders in schools. A review of the literature reveals that some
educators are helping to lead the integration and use of technology in schools. These teacher technology
leaders are characterized as being reflective of their educational experiences, aware of current
technological trends, savvy with technology, and displaying ownership in the success of the school.
Teacher technology leaders are also described as collaborators, mentors, and action and scholarly
researchers. These activities sometimes lead to professional engagement with other teachers in online and
professional communities.

I recently contacted Terry Atchison (Technology Initiatives – ALSDE) and Brad Johnson (Enterprise City
Schools – System Technologist) regarding schools where teacher technology leadership may be present.
They identified Auburn City Schools as being leaders in the use of technology in the classroom. Both
also specifically mentioned Auburn Junior High School as being a hotspot for innovation with
technology. I would like the opportunity to interview some of the teachers and administrators of Auburn
Junior High School in order to gain further insight into these characteristics of leadership. I would like to
conduct interviews/observations with some of the faculty and administrative personnel. Any data gathered
from my research would be kept confidential and would follow the guidelines of the Institutional Review
Board of Auburn University.

If you have any questions, I can be reached at 334–464–0863 (cell), 334-347-6858 (office) or my email at
either mhowell@enterpriseschools.net or mph0005@auburn.edu. You may also contact my chair Dr.
Ellen H. Reames, Professor in the Auburn University Department of Educational Foundations, Leadership
and Technology. Her telephone number is 334-844-3067 or you can email her at reamseh@auburn.edu.

Sincerely,

Marcus Paul Howell

Marcus Paul Howell

Auburn City Schools
Application for External Research Approval

For information or assistance contact The Office of the Associate Superintendent, 855 E. Samford Avenue, P.O. Box 3270, Auburn, AL 36831
Phone: 334-887-1906

Part I-General Information

1. Proposed Start Date of Research Observation/Data Collection   September, 2011

2. Anticipated Duration of the Study: 1 to 2 days

3. Title of Research Project: Teacher's as Technology Leaders

4. Researcher's Name   Marcus Paul Howell

5. Name of Sponsoring Institution: Auburn University

6. Department or Division: Educational Foundations, Leadership and Technology

7. Address: 4th floor Haley Center

8. E-mail address: mph0005@auburn.edu   Office Phone: 334-347-6858   Cell Phone: 334-464-0863

PART II-Purpose

9. Clearly state the purpose of this project.

   The need for technologically minded leadership in schools is key to adequately preparing students with 21st century skills. In some schools, teachers are helping administrators lead the integration and use of technology. This project will identify some of the characteristics of teacher technology leaders.

10. Briefly describe the methodology to be used.

   This is a qualitative study using interviews and observations to identify some of the traits of teacher technology leaders.

11. How will the results of this project be used? (Publication, Presentation, Dissertation, etc.)

   The results of this project will be used to complete the requirements of my dissertation.

12. Will a summary of the findings be made available to Auburn City Schools?   Yes ☒   No ☐
   If no, please explain.

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Part III-Subjects

13. Describe the participant population (include the number of participants needed) you are asking to include in this project.

I would like to initially interview teachers and administrators who are identified by the system technologist and principal as technology leaders. Snowballing will be used to identify other potential participants.

14. Describe why this participant population is being selected.

I will be using two different frameworks to identify how teacher technology leaders vary from the leadership traits of administrators leading the integration and use of technology.

15. What basis will you use to recruit/select those participants from the population to be included in the study (if not adequately explained in #13 above)?

Terry Atchison (Technology Initiatives - ALSDE) and Brad Johnson (Enterprise City Schools -System Technologist) both identified Auburn City Schools as being leaders in the integration and use of technology. Both when questioned specifically identified Auburn Junior High School as serving as a model for innovation. Their high recommendations has led me to make application in the hopes of interviewing teachers who are working beyond the confines of their own classroom, to collaborate, train and support their fellow teachers in using technology.

16. Will any Auburn City Schools employee(s) be required to invest any time in distributing information, collecting data or in any other way contribute time and effort to this research project? If yes, explain.

Yes ☒   No ☐

I would like to interview any willing participants at a time of their convenience.

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Part IV.-Summary

	Yes	No
17. Will all data collected be anonymous?	☐	☒
18. If data is not anonymous, will it be confidential?	☒	☐
19. Will there be any compensation or incentives for participants?	☐	☒
20. Has this study been approved by an Institutional Review Board?	☒	☐

Additional comments or questions from the researcher:

Researcher Signature: *Maurs Paul Howell*　　Date Submitted September 2, 2011

For Auburn City School Use Only

Date Received: _____　　　　Received by: _____

Approved: ✓　　Not Approved: _____　　Date: 9/16/11

Comments: Debbie Rice will serve as ACS host to this project.

ACS Administrator Signature: Cristen Herring

MR. Howell,
Contact Debbie Rice 887-1920 for information and administration of your project.

Appendix 2

Participant Consent Form

Auburn University

Auburn University, Alabama 36849-5221

Educational Foundations
Leadership and Technology
4036 Haley Center

Telephone: (334) 844-4460
Fax: (334) 844-3072

(NOTE: DO NOT AGREE TO PARTICIPATE UNLESS AN IRB APPROVAL STAMP WITH CURRENT
DATES HAS BEEN APPLIED TO THIS DOCUMENT.)

INFORMATION LETTER
FOR A RESEARCH STUDY ENTITLED

Teachers as Technology Leaders

You are invited to participate in a research study about the role of teachers as technology leaders
in schools. Marcus Paul Howell is conducting the study, under the direction of Dr. Ellen H.
Reames, Professor in the Auburn University Department of Educational Foundations, Leadership
and Technology. You were selected as a possible participant because of your role and experience
with technology in the classroom

What will be involved if you participate? If you decide to participate in this research study, you
will be interviewed. The interview will not last longer than one hour and will be audio taped. No
names of participants or locations will be identified in the recordings. The audio recordings will
be kept on a secure, password protected computer. The individual files will be encrypted for
added security. All audio files will be deleted June 1, 2012.

There will be no risk or discomforts associated with this research. If you participate in this study,
you can expect to identify the possible role some teachers may play in leading the integration and
usage of technology in schools

There will be no cost or expenses if you choose to participate in this research.

If you change your mind about participating, you can withdraw at any time during the study.
Your participation is completely voluntary. If you choose to withdraw, your data can be
withdrawn as long as it is identifiable. Your decision about whether or not to participate or to
stop participating will not jeopardize your future relations with Auburn University, or your
respective institution, school or department.

Any data obtained in connection with this study will remain confidential. Information collected
through your participation may be used to fulfill an educational requirement, published in a
professional journal, and/or presented at a professional meeting.

Page 1 of 2

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If you have any questions about this study, please email me at mph0005@auburn.edu or call me at (334) 464-0863. You may also contact my advisor, Dr. Ellen H. Reames at (334) 844-3067 or reamseh@auburn.edu.

If you have questions about rights as a research participant, you can contact the Auburn University Office of Human Subjects Research or the institutional Review board by phone (334) 844-5966 or email at hsubjec@auburn.edu or IRBChair@auburn.edu

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE IF YOU WANT TO PARTICIPATE IN THIS RESEARCH PROJECT. IF YOU DECIDE TO PARTICIPATE, THE DATA YOU PROVIDE WILL SERVE AS YOUR AGREEMENT TO DO SO. THIS LETTER IS YOURS TO KEEP.

_____   _____
Investigator's signature   Date

_____
Print Name
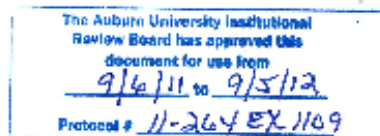
_____   _____
Co-Investigator   Date

_____
Printed Name

Appendix 3

Auburn University Institutional Review Board (IRB) Permission Form

AUBURN UNIVERSITY INSTITUTIONAL REVIEW BOARD for RESEARCH INVOLVING HUMAN SUBJECTS

R E S E A R C H   P R O T O C O L   R E V I E W   F O R M

For Information or help contact THE OFFICE OF RESEARCH COMPLIANCE, 115 Ramsay Hall, Auburn University
Phone: 334-844-5966   e-mail: hrubjec@auburn.edu   Web Address: http://www.auburn.edu/research/vpr/ohs/

Revised 03.26.11 – DO NOT STAPLE, CLIP TOGETHER ONLY.

1. PROPOSED START DATE of STUDY: August 20, 2011

PROPOSED REVIEW CATEGORY (Check one):   FULL BOARD   EXPEDITED   ☑ EXEMPT

2. PROJECT TITLE Teachers as Technology Leaders

3. Marcus Paul Howell   Educator   334-464-0960   mph0006@auburn.edu
   PRINCIPAL INVESTIGATOR   TITLE   DEPT   PHONE   AU E-MAIL

   206 Aaron Drive, Enterprise, AL 36330   334-347-1322   mhowell@enterpriseschools.net
   MAILING ADDRESS   FAX   ALTERNATE E-MAIL

4. SOURCE OF FUNDING SUPPORT: ☑ Not Applicable __ Internal __ External Agency:_____ ☐ Pending ☐ Received

5. LIST ANY CONTRACTORS, SUB-CONTRACTORS, OTHER ENTITIES OR IRBs ASSOCIATED WITH THIS PROJECT:

6. GENERAL RESEARCH PROJECT CHARACTERISTICS

6A. Mandatory CITI Training

Names of key personnel who have completed CITI:
Ellen H. Reames

_____   _____

_____   _____

CITI group completed for this study:
   Social/Behavioral   Biomedical

**PLEASE ATTACH TO HARD COPY ALL
CITI CERTIFICATES FOR EACH KEY
PERSONNEL**

6B. Research Methodology

Please check all descriptors that best apply to the research methodology.

Data Source(s): ☑ New Data   Existing Data

Will recorded data directly or indirectly identify participants?
              Yes   ☑ No

Data collection will involve the use of:
__ Educational Tests (cognitive diagnostic, aptitude, etc.)
☑ Interview / Observation
   Physical / Physiological Measures or Specimens (see Section 6D)
   Surveys / Questionnaires
   Internet / Electronic
   Audio / Video / Photos
   Private records or files

6C. Participant Information

Please check all descriptors that apply to the participant population.
☑ Males   ☑ Females   AU students
Vulnerable Populations
   __ Pregnant Women/Fetuses   __ Prisoners
   __ Children and/or Adolescents (under age 19 in AL)
Persons with:
   __ Economic Disadvantages   __ Physical Disabilities
   __ Educational Disadvantages __ Intellectual Disabilities
Do you plan to compensate your participants? __ Yes ☑ No

6D. Risks to Participants

Please identify all risks that participants might encounter in this research.
☑ Breach of Confidentiality*   __ Coercion
__ Deception   __ Physical
__ Psychological   __ Social
__ None   __ Other

RECEIVED
SEP 2 3 2011

_____

*Note that if the investigator is using or accessing confidential or identifiable data, breach of confidentiality is always a risk.

Do you need IBC Approval for this study? __ No ☐ Yes - BUA #_____   Expiration date_____

2nd revision

FOR OHSR OFFICE USE ONLY

DATE RECEIVED IN OHSR: 9/23/11 by Cb   PROTOCOL # 11-264 EX 1109
DATE OF IRB REVIEW: 9/6/11   by KTE   APPROVAL CATEGORY: 45 CFR 46.101(b)(2)
DATE OF IRB APPROVAL: _____   by ____   INTERVAL FOR CONTINUING REVIEW: 1 year
COMMENTS: original 8/19/11
          1st revisions 9/14/11

7. PROJECT ASSURANCES

PROJECT TITLE:

A. PRINCIPAL INVESTIGATOR'S ASSSURANCES

1. I certify that all information provided in this application is complete and correct.
2. I understand that, as Principal Investigator, I have ultimate responsibility for the conduct of this study, the ethical performance this project, the protection of the rights and welfare of human subjects, and strict adherence to any stipulations imposed by the Auburn University IRB.
3. I certify that all individuals involved with the conduct of this project are qualified to carry out their specified roles and responsibilities and are in compliance with Auburn University policies regarding the collection and analysis of the research data.
4. I agree to comply with all Auburn policies and procedures, as well as with all applicable federal, state, and local laws regarding the protection of human subjects, including, but not limited to the following:
   a. Conducting the project by qualified personnel according to the approved protocol
   b. Implementing no changes in the approved protocol or consent form without prior approval from the Office of Human Subjects Research
   c. Obtaining the legally effective informed consent from each participant or their legally responsible representative prior to their participation in this project using only the currently approved, stamped consent form
   d. Promptly reporting significant adverse events and/or effects to the Office of Human Subjects Research in writing within 5 working days of the occurrence.
5. If I will be unavailable to direct this research personally, I will arrange for a co-investigator to assume direct responsibility in my absence. This person has been named as co-investigator in this application, or I will advise OHSR, by letter, in advance of such arrangements.
6. I agree to conduct this study only during the period approved by the Auburn University IRB.
7. I will prepare and submit a renewal request and supply all supporting documents to the Office of Human Subjects Research before the approval period has expired if it is necessary to continue the research project beyond the time period approved by the Auburn University IRB.
8. I will prepare and submit a final report upon completion of this research project.

My signature indicates that I have read, understand and agree to conduct this research project in accordance with the assurances listed above.

Marcus Paul Howell		August 9, 2011
Printed name of Principal Investigator	Principal Investigator's Signature (SIGN IN BLUE INK ONLY)	Date

B. FACULTY ADVISOR/SPONSOR'S ASSURANCES

1. By my signature as faculty advisor/sponsor on this research application, I certify that the student or guest investigator is knowledgeable about the regulations and policies governing research with human subjects and has sufficient training and experience to conduct this particular study in accord with the approved protocol.
2. I certify that the project will be performed by qualified personnel according to the approved protocol using conventional or experimental methodology.
3. I agree to meet with the investigator on a regular basis to monitor study progress.
4. Should problems arise during the course of the study, I agree to be available, personally, to supervise the investigator in solving them.
5. I assure that the investigator will promptly report significant adverse events and/or effects to the OHSR in writing within 5 working days of the occurrence.
6. If I will be unavailable, I will arrange for an alternate faculty sponsor to assume responsibility during my absence, and I will advise the OHSR by letter of such arrangements. If the investigator is unable to fulfill requirements for submission of renewals, modifications or the final report, I will assume that responsibility.
7. I have read the protocol submitted for this project for content, clarity, and methodology

Dr. Ellen H. Reames		August 9, 2011
Printed name of Faculty Advisor / Sponsor	Signature (SIGN IN BLUE INK ONLY)	Date

C. DEPARTMENT HEAD'S ASSSURANCE

By my signature as department head, I certify that I will cooperate with the administration in the application and enforcement of all Auburn University policies and procedures, as well as all applicable federal, state, and local laws regarding the protection and ethical treatment of human participants by researchers in my department.

Sherida Downer		8/18/2011
Printed name of Department Head	Signature (SIGN IN BLUE INK ONLY)	Date

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8. **PROJECT OVERVIEW:** Prepare an abstract that includes:
(400-word maximum, in language understandable to someone who is not familiar with your area of study);

    I.) A summary of relevant research findings leading to this research proposal;
      (Cite sources; include a "Reference List" as Appendix A.)
    II.) A brief description of the methodology,
    III.) Expected and/or possible outcomes, and,
    IV.) A statement regarding the potential significance of this research project.

I. The need for technologically minded leadership in schools has arisen because of the need to overcome obstacles to the integration of technology, and to meet the pedagogical shift that is occurring in classrooms (Ba, 2011; Charalambous, Ioannou, & Tzounis, 2011; Lambert, Gong, & Cuper, 2008; Many administrators are not prepared to lead the integration of technology into the classroom (Flanagan & Jacobsen, 2003; Gunz, 2004). Leaders are emerging from classrooms, libraries and computer labs to help provide direction for the technological changes taking place (Flanagan & Jacobsen, 2003; Riel & Becker, 2008).

II. The International Society for Technology in Education NETS-A performance indicators were used as a framework. (1) visionary leadership, (2) digital age learning culture, (3) excellence in professional practice, (4) systematic improvement, (5) digital citizenship.

III. The expected results is that many administrators are poorly prepared to lead the integration of technology. Teachers are helping to drive the direction of technology usage in schools.

IV. There has been little research published specifically in the area of teacher technology leadership in schools (McLeod & Richardson, 2011). Technology has become commonplace in the classroom (Jukes, McCain & Crockett, 2010). As technology continues to make increased pathways into our society and our schools, it falls to teacher leaders to help lead schools in preparing our students to be digital citizens (Riel & Becker, 2008).

9. **PURPOSE.**
    a. **Clearly state all of the objectives, goals, or aims of this project.**
        The purpose of this study was to identify teacher leaders within one school and the role they play in leading the integration and use of technology.

    b. **How will the results of this project be used?** (e.g., Presentation? Publication? Thesis? Dissertation?)
Dissertation

10a. KEY PERSONNEL. Describe responsibilities. Include information on research training or certifications related to this project. CITI is required. Be as specific as possible. (Attach extra page if needed.) All non AU-affiliated key personnel must attach CITI certificates of completion.

Principle Investigator: Marcus Paul Howell _____ Title: Graduate Student   E-mail address mhowell@enterpriseschools.net
Dept / Affiliation: EFLT _____

Roles / Responsibilities:
The purpose of this individual will be to serve as researcher in gathering data and reviewing the data inorder to get the desired outcome of the study. Data will be collected from interviews with faculty members and administrators at Auburn Junior High School. Citi training has been completed in order to complete the requested research.

Individual: Ellen H. Reames _____ Title: Chair _____ E-mail address reamseh@auburn.edu
Dept / Affiliation: EFLT _____

Roles / Responsibilities:
The faculty advisor will oversee the advising of the project, assistance with data collection, analysis and reporting of findings.

Individual: _____ Title: _____ E-mail address _____
Dept / Affiliation: _____

Roles / Responsibilities:

Individual: _____ Title: _____ E-mail address _____
Dept / Affiliation: _____

Roles / Responsibilities:

Individual: _____ Title: _____ E-mail address _____
Dept / Affiliation: _____

Roles / Responsibilities:

Individual: _____ Title: _____ E-mail address _____
Dept / Affiliation: _____

Roles / Responsibilities:

11. LOCATION OF RESEARCH. List all locations where data collection will take place. (School systems, organizations, businesses, buildings and room numbers, servers for web surveys, etc.) Be as specific as possible. Attach permission letters in Appendix E.
(See sample letters at http://www.auburn.edu/research/probns/samps.htm)

Auburn Junior High School, Auburn City Schools, Teacher Classrooms, Fall 2011. Kristen Hering, Assistant Superintendent, Auburn City Schools has been contacted and has given permission for the research to be conducted with school personnel.

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12. PARTICIPANTS.
   a. Describe the participant population you have chosen for this project.
        Check here if there is existing data; describe the population from whom data was collected & include the # of data files.

       Public school teachers

   b. Describe why is this participant population is appropriate for inclusion in this research project. (Include criteria for selection.)

       The purpose of this study was to ascertain the role if any of teachers in providing leadership with technology

   c. Describe, step-by-step, all procedures you will use to recruit participants. Include in *Appendix B* a copy of all e-mails, flyers, advertisements, recruiting scripts, invitations, etc. that will be used to invite people to participate.
       (See sample documents at *http://www.auburn.edu/research/rd/discsample.htm.*)

       I will make contact with Kristen Herring, Assistant Supt. of Auburn City Schools seeking permission to interview school personnel. Once permission has been granted I will make contact with the system technology coordinator and principal of the junior high school. The consent letter explaining my research will be sent to both individuals. If they agree to participate, I will ask for names of teachers that they designate as technology leaders within the school. Consent letters will be mailed to those individuals. They will be informed through the consent letter and later before the interview process begins that they can withdraw from the process at anytime. They will also be informed that they do not have to answer some, any or all questions.

       What is the minimum number of participants you need to validate the study? __1_____

       Is there a limit on the number of participants you will recruit?   ☑ No   ☐ Yes – the number is _____

       Is there a limit on the number of participants you will include in the study?   ☐ No   ☑ Yes – the number is 50_____

   d. Describe the type, amount and method of compensation and/or incentives for participants.
       (If no compensation will be given, check here ✔)

       Select the type of compensation: ___ Monetary   ___ Incentives
                                                         ___ Raffle or Drawing incentive (Include the chances of winning.)
                                                         ___ Extra Credit (State the value)
                                                         ___ Other
       Description:

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13. PROJECT DESIGN & METHODS.

a. Describe, step-by-step, all procedures and methods that will be used to consent participants.
[___ Check here if this is "not applicable"; you are using existing data.]

This study focuses on emerging leadership in technology from teachers. I will mail the consent form together in a packet to potential participants. The cover letter will explain the purpose of the study and the fact that participants and will identify that all information will be gathered confidentially. Participants will be informed in the cover letter that they can withdraw at any time. The letter states that their involvement and participation is completely voluntary and they may choose to answer all, some, or none of the questions. [I can withdraw at any time. Contact information is included so that participants may ask questions. Contact info consists of the principal investigator's email and physical address, plus telephone number.

b. Describe the procedures you will use in order to address your purpose. Provide a step-by-step description of how you will carry out this research project. Include specific information about the participants' time and effort commitment. (NOTE: Use language that would be understandable to someone who is not familiar with your area of study. Without a complete description of all procedures, the Auburn University IRB will not be able to review this protocol. If additional space is needed for this section, save the information as a PDF file and insert after page 6 of this form.)

Semi-structured interviews will be used. Data will be confidentially using a digital recorder. The files will be transferred to a networked computer. The files will be secured using compression software.

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13c. List all data collection instruments used in this project, in the order they appear in Appendix C.
(e.g. surveys and questionnaires in the format that will be presented to participants, educational tests, data collection sheets, interview questions, and video taping methods etc.)

Interview questions. SEE APPENDIX C

d. Data analysis: Explain how the data will be analyzed.
The data will be analyzed using Atlas.ti computer software.

14. RISKS & DISCOMFORTS: List and describe all of the risks that participants might encounter in this research. *If you are using deception in this study, please justify the use of deception and be sure to attach a copy of the debriefing form you plan to use in Appendix D.* (Examples of possible risks are in section #60 on page 1.)

There should be no discomforts encountered by the participants because they can withdraw at any time.

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15. PRECAUTIONS. Identify and describe all precautions you have taken to eliminate or reduce risks as listed in #14. If the participants can be classified as a "vulnerable" population, please describe additional safeguards that you will use to assure the ethical treatment of these individuals. *Provide a copy of any emergency plans/procedures and medical referral lists in Appendix D.*

The participants are not vulnerable populations. All participants will be informed through the cover letter that they do not have to answer any questions they do not wish to answer and can withdraw at any time. I will use pseudonyms; no real names of teachers or of the school will be identified.

If using the Internet to collect data, what confidentiality or security precautions are in place to protect (or not collect) identifiable data? Include protections used during both the collection and transfer of data. *(These are likely listed on the servers website.)*

Not using the Internet. Participants will not be coded in any way. The files will be secured on one computer and password protected with compression software.

16. BENEFITS.
   a. List all realistic direct benefits participants can expect by participating in this specific study.
      (Do not include "compensation" listed in #12d.)   Check here if there are no direct benefits to participants. ✔

   Direct benefits will be to advance the limited research concerning teachers as technological leaders in schools.

   b. List all realistic benefits for the general population that may be generated from this study.

   Teachers who are better prepared to lead in the integration and usage of technology will possibly better serve the needs of students.

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17. PROTECTION OF DATA.

    a. Will data be collected as anonymous?   ☐ Yes   ☑ No   *If "YES", skip to part "g".*
        ("Anonymous" means that you will not collect any identifiable data.)

    b. Will data be collected as confidential?   ☑ Yes   ☐ No
        ("Confidential" means that you will collect and protect identifiable data.)

    c. If data are collected as confidential, will the participants' data be coded or linked to identifying information?
        ■ Yes (If so, describe how linked.)   No ■

    We will not code participants. All data will be confidential.

    d. Justify your need to code participants' data or link the data with identifying information.

    Not applicable.

    e. Where will code lists be stored? (Building, room number?)

    Not applicable.

    f. Will data collected as "confidential" be recorded and analyzed as "anonymous"?   ☑ Yes   ☐ No
        (If you will maintain identifiable data, protections should have been described in #15.)

    g. Describe how and where the data will be stored (e.g. hard copy, audio cassette, electronic data, etc.), and how the location where data is stored will be secured in your absence. For electronic data, describe security. If applicable, state specifically where any IRB-approved and participant-signed consent documents will be kept on campus for 3 years after the study ends.

    Non-digital materials will be kept in a filing cabinet in the principal investigator's office at Hillcrest Elementary School. The drawer is kept locked. Digital recordings will be located on one password protected computer. The files will be encrypted. All digital files will be deleted June 1, 2012. The digital files will be deleted from the computer.

    h. Who will have access to participants' data?
        (The faculty advisor should have full access and be able to produce the data in the case of a federal or institutional audit.)

    The investigator and advisor

    i. When is the latest date that confidential data will be retained? (Check here if only anonymous data will be retained. ☐)

    May 2013.

    j. How will the confidential data be destroyed? *(NOTE: Data recorded and analyzed as "anonymous" may be retained indefinitely.)*
    The zip file will be deleted.

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Appendix 4

Semi-Structured Interview Questions

What do you think is the role of the administrator in regards to technology?

What are some examples of technology being used in your classroom to teach 21st century skills?

What is your role as a classroom teacher in regards to technology?

Your principal or system technologist has identified you as a leader in the use of technology in the school. How do you lead?

Describe some of your experiences in working with others to integrate and use technology.

Are you empowered in your school? If so how?

Appendix 5

Open/ a priori Codes

Codes	Definitions	Exemplary Data	Question
21st Century Skills	(a) creativity and innovation; (b) communication and collaboration; (c) research and information fluency; (d) critical thinking, problem solving, and decision making; (e) digital citizenship and; (f) technology operations and concepts.	"We have students who are able to work on group projects and share the information in ways that I only dreamed about years ago. We have students who are able to retrieve primary documents, or they're able to use software that will actually transport them electronically to a specific location somewhere around the globe and they can actually go from bird's eye view to street view, and in some cases even go inside the structure to look at it."	Is there a lot of student-centered instruction taking place in classrooms?
Collaboration	To work jointly with others or together especially in an intellectual endeavor.	"We share a lot of resources whether it's myself or any of the other social studies teachers and like "here is what I'm doing." Then I can take it back to my classroom try it or they can take what I've shared and take it to their classroom and try it. It really is a good use of time I think in the school. I think that all of our social studies teachers are more on the same page now than we've ever been."	How does horizontal planning factor into technology leadership at Tigerland Junior High School?
Culture	The set of shared attitudes, values, goals, and practices that characterizes an institution or organization	"All of our stakeholders have bought into this. It's been very positive for us. We have had hiccups along the way as you would with any program. But we have found it to be -- it's a part of who we are. If you were to advise us that we would not have a laptop program at our school anymore, we would have to reinvent ourselves again because it is so much a part of who we are."	What has been the stakeholder response to the laptop initiative?

Codes	Definitions	Exemplary Data	Question
Technology Trends	A line of general direction or movement in regards to technology usage in schools.	"I mean it's just like the iPads, you know, now that the schools are becoming iPad schools, the reading that you do right now, everything around the iPad is about the app."	What is the next step for Tigerland Junior High School?
Planning	A strategy for achieving an objective.	"We also have horizontal planning which enables all of our teachers in a certain core subject across the grade level to meet, and we schedule this twice a year and it enables those teachers to have half the school day to focus on the curricular areas of that content area. And we also have technology training that we have on a weekly basis, ongoing, that sometimes its departmental specialized but sometimes it is not. Again, that helps build collegiality among our members. Sometimes it's led by a faculty member who has expertise or interest in a certain area. In some cases it is led by our technology coach, or by an outside person who's been selected to come in."	Tell me about your teachers sharing and collaborating on things.
Professional Development	Ongoing education for educators. Increased teacher knowledge will improve student achievement.	"If we had not done professional development for a year, I can guarantee you that teachers would have had the students put their laptops under their desk until they could get comfortable with the machine because if a teacher does not feel comfortable then I'm not going to let you play with it when I don't even know how to use it yet. So, I think that as far as our campus goes and you could probably ask any, some would probably say they would have rather had a little bit more but I think you would have that if you'd give them two years, somebody would have wanted a few more months but I honestly think that is what has helped the whole launch be successful on our campus."	You think that a year of professional development was the key to changing the school's culture?

Codes	Definitions	Exemplary Data	Question
Shared Vision	A sense of commonality that permeates the organization and gives coherence to diverse activities.	"The idea was born by some of our school district leaders, "wouldn't that be great if we could incorporate laptops, a laptop program?" So, from that conversations began and that vision was shared with the school leadership here at that time which I was a partner and very honored to have been a member. We began researching it, talking to school districts who already had them underway, laptop initiatives underway. We also talked to those who had attempted but not been successful because we wanted to learn from them as well."	Tell me a little bit more about the laptop initiative.
Steering Committee	Core group of teacher leaders and administrators who visited schools and performed research regarding the implementation of the one-to-one laptop initiative.	"We gave some careful thoughts of that because you want teachers who are knowledgeable and also a good representation of your faculty. So, we looked to teachers who would have an interest who perhaps had demonstrated before their desire on their own to incorporate as much technology as possible. So, we're looking for teachers who had best practices in mind, more effective in their classroom and would be willing to invest the time and the energy plus you also want teachers who will give you a good rounded feedback along the way. You want people who will critically review so that it's not just automatic "oh yes, yes, yes" but it's "Well, we need to consider this" or "We need to look at that."	How did you choose your steering committee members?
Support	Providing assistance in maintaining the hardware and utilizing software to provide instruction.	"He [IT Coach] helps with integrating technology into the curriculum. He's a certified teacher. He came out of our ranks of teachers here. His focus is how teachers can use the technology in the classroom. We also have a fulltime technician who was here for the purpose of helping us keep the hardware functional."	Have you got more teachers leading technology?

NETS-A (2009) Administrative Technology Leadership a priori Codes

Codes	Definitions	Exemplary Data	Questions
Visionary Leadership	The administrator leads the shared vision for technology usage throughout the curriculum.	"The idea was born by some of our school district leaders, who said 'wouldn't that be great if we could incorporate a laptop program?' So, from that conversations began and that vision was shared with the school leadership here at that time which I was a partner and very honored to have been a member."	I interviewed the DTC and asked her about the origins of the one-to-one laptop initiative.
Digital Age Learning Culture	The administrator creates and promotes a technologically enhanced culture that supports the learning needs of 21st century students.	"We have very regular intensive training because we realized our teachers work various levels of competence and confidence. So, we had to ascertain where was each teacher and how could we carry that person from introduction into the program and then maximize that person's potential. Along the way, we had some teachers who were younger in the career, helping out teachers who had been in the career for many years. So, that was a great partnership because once again, having that youthful excitement and exuberance helps the teacher who's been doing it -- has been in the career path awhile but maybe doesn't have the comfort level and so they can help each other."	I interviewed the AP and asked her about how the laptop program would benefit the school.

Codes	Definitions	Exemplary Data	Questions
Excellence in Professional Practice	The administrator strives to promote a professional environment that supports the use of digital resources in the classroom...	"So it was a lot of that. We did focus a lot on professional development with the principals. Typically we provide the device or whatever software, they do their PD pace; so we provide them with laptops well in advanced of providing other people just like the iPads now. We've provided the principals with the iPads to begin with because they have to understand what it is they're asking their teachers to do and I think if principals don't understand what they're asking their teachers to do that's huge problem. It's just like software. When you buy software, principals need to understand what that software does, just don't put it out there. So our principals are very involved in the selection of software, they know what software is out, they go through the same professional development or to have more of awareness not necessarily end user mentality but they know more about what that software does."	I asked the DTC how the school's culture came to embrace technological change.
Systematic Improvement	The administrator provides constant monitoring to move the integration and use of technology forward in the classroom.	"Well, also we try to help educate the parent. We have orientation sessions for parents and that's part of the in addition to our users agreement form that we have the parent and the student signed together is that the parents realize this is a partnership and that we encourage the families to use these laptops at home as teaching tools. If the parents consider it's important for them to have the social networking access, then they might want to consider that having it on their personal home computers but not on the school equipment as I've often say in my orientation sessions."	I asked the AP about parental involvement with the one-to-one laptop initiative.
Digital Citizenship	The administrator serves as a model to promote safe practices in the use of technology.	"Well, one of our goals is for our students to be responsible users of technology or consumers of technology realizing that there's a responsibility that we have to help guide those students, help protect them as much as we can from sites and predators on the network. We also share that responsibility with our students."	I asked the AP how they handle teaching students to be digital citizens.

Diane L. Yee (2000) Administrative Technology Leadership a priori Codes

Codes	Definitions	Exemplary Data	Questions
Equitable Providing	Fair-minded access to technology in classrooms, library media centers and computer labs.	"So, I think support is critical to the success of the program, and that is one of the reasons we were adamant about making certain that we had someone who is within the faculty ranks to be focused on dedicated to the technology integration. And that we had a hardware expert with like more of the technical parts of the laptop who is on staff because we know we now have almost 1100 students, and then if you consider the fact, we have probably 80 faculty members with laptops. So, you add those together and that gives you an idea of how many laptops we have. That does not include all the desktops on campus."	Tell me about your teachers sharing and collaborating with technology.
Learning-focused Envisioning	Communicating a shared vision throughout the school and to all stakeholders is of vital importance to successful leadership.	"There were a couple that did and the thing is Marcus what you'll begin to see is even those teachers when they see that kids are becoming engaged, you're going to change a lot of the way they - you'll begin to see them change just to become more in line with more excited about what they're doing instead of teaching the old way and shouldn't say the old way but in different ways."	I asked the DTC about the steering committee members

Codes	Definitions	Exemplary Data	Questions
Adventurous Learning	Demonstrates a willingness to master and then share technology skills with others.	"Absolutely, and we've evolved over the years through that. We have had extensive training and cooperative learning and persistent issues in history, which we've done in concert with Auburn University. That's very exciting to watch. We have had extensive research and effective questioning and higher order thinking and how you pull students out and really make them partners in their learning. The idea of the teacher being in the middle of the room or in front of the room, importing all the knowledge is not our standard way of instruction."	I asked the AP about student-centered instruction.
Patient Teaching	Technology instruction to any and all interested stakeholders.	"We have very regular intensive training because we realized our teachers work various levels of competence and confidence. So, we had to ascertain where was each teacher and how could we carry that person from introduction into the program and then maximize that person's potential. Along the way, we had some teachers who were younger in the career, helping out teachers who had been in the career for many years. So, that was a great partnership because once again, having that youthful excitement and exuberance helps the teacher who's been doing it."	I was asking the AP how so many teachers became excited about the laptop initiative.

Codes	Definitions	Exemplary Data	Questions
Protective Enabling	Creation of leadership opportunities for teachers and students.	"We also have horizontal planning which enables all of our teachers in a certain core subject across the grade level to meet, and we schedule this twice a year and it enables those teachers to have half the school day to focus on the curricular areas of that content area. And we also have technology training that we have on a weekly basis, ongoing, that sometimes its departmental specialized but sometimes it is not. Again, that helps build collegiality among our members. Sometimes it's led by a faculty member who has expertise or interest in a certain area. In some cases it is led by our technology coach, or by an outside person who's been selected to come in."	I asked the AP about the teachers working collaboratively on technological projects in the classroom.
Constant Monitoring	Instruction is in line with the vision and goals of the school.	"You've got to understand what they're talking about. So she took me and made me do the or made me type the plan out so they would be sitting there talking about scope and sequence and horizontal this and vertical that and I'm going What are they talking about? Well then it's just making me stay in that space and having conversations, so now you know when you talk about meeting horizontal like when you talk about meeting vertically, I understand what they're talking about. When you talk about scope and sequence I understand there's a path to get from 1st grade to 12th grade. There's a sequence as to how courses should be delivered, I get all of that and I think that's what the education part has done."	I asked the DTC about her background in business and if her experience helped her envision the needs of student learners.

Codes	Definitions	Exemplary Data	Questions
Entre-preneurial Networking	Securing adequate support for the program.	"she said no superintendent, no principal will rise above the superintendent and no teacher will ever rise above the principal. So if you want something to take off first you go to superintendent, get his approval and then so you have to have the buy end of those two facilities or those two stakeholders right off the bat because again one teacher in a classroom can only do what they're doing in the classroom, the principal that doesn't approve by that."	I asked the DTC about administrative support of the laptop initiative.
Careful Challenging	Administrators thinking "outside the box" and "challenging assumptions."	"Oh Lord, here we go...The shock started to wear off and then we got our machines and kind of got into, they started doing presentations of Dino, presentations of the journaling, that's on the Microsoft journal thing, the one note that's on their which is just an organization tool, Smart, just all these different kinds of programs that we could use and it became system overload for a lot of the teachers.	I asked the AP about what it was like when the professional development activities began to occur.

NETS - T (2008) Teacher Technology Standards a priori Codes

Codes	Definitions	Exemplary Data	Questions
Design and Develop Digital-Age Learning Experiences and Assessments	Teachers design and evaluate learning experiences that utilize technology to maximize learning.	Well, I feel like in my classroom I think that technology just helps build a better backbone for them because I remember growing up and all we ever had to do in science was we had the book and we'd have 20 questions. You have to read the book and do the 20 questions and read the book and do the 20 questions. It wasn't until I got to high school, so I had a lecture. But with these kids, we can do online labs. We can talk about how a roller coaster works. I can teach everything that I have to teach from the beginning, from the course of study, objective 8, to course of study objective 12 just by setting up a roller coaster in our room and getting online and finding out all the different types of roller coasters.	But does technology help you to improve this ñ identify the gaps so to speak or you know we miss this or they got this really strong?

Codes	Definitions	Exemplary Data	Questions
Engage in Professional Growth and Leadership	Teachers promote the effective use of tools by serving as models of lifelong learning.	Between [Tigerland City Schools] and Auburn University, we have a council called the Professional Development System. They meet together back and forth. The only reason why I know is I'm actually the liaison for the school system but there are forms that you can fill out online that say I need help with this. So, you can ask for technology help and they can come in. A lot of our lab students that are learning how to be new teachers and cooperating teachers, we bring them in and we teach them how to do what we do. They take a technology class there and then they have to come and use those problems and solutions and come in here and use our technology.	What about the university? Do you utilize any resources of the university? Do they come over and do anything tech-wise or professional-wise?
Facilitate and Inspire Student Learning and Creativity	Teachers use their knowledge to facilitate and inspire student learning.	You put boundaries on somebody and who knows where that little innovative leap, somebody is going to come up with the way of working a problem or I know pretty much this level of math, it's very clear cut. It's very linear. It's very straight. There are certain ways of doing things and we do present that. This is the best most efficient, most elegant way of working a math problem. Some of them might have just something a little bit different. That might be the way that they understand it and they learn it and they retain it better that way. I'm never going to say that this is the way we work problem if you work on it another way, its wrong.	You still have any boundaries in here?

Codes	Definitions	Exemplary Data	Questions
Model Digital-Age Work and Learning	Demonstrate fluency of current technology.	It wouldn't matter if I was here or I was in Washington, D.C. or Beijing, China as long as I had access to the software, I could still teach the class. Now still, it's much better if I'm standing in front of the classroom and I can see their reaction and I can just see when the light bulb goes off and they know what they're talking about. It's much easier to do that but as for being able to be present in the classroom, no. It doesn't matter where you are in the classroom. It's not bound by the four walls anymore.	I asked M1/TTL for an explanation of how he uses the DyKnow software.
Promote and Model Digital Citizenship and Responsibility	Teachers exhibit ethical behavior in the pedagogical practices.	Well, one of our goals is for our students to be responsible users of technology or consumers of technology realizing that there's a responsibility that we have to help guide those students, help protect them as much as we can from sites and predators on the network. We also share that responsibility with our students.	I asked about digital citizenship

Riel and Becker (2008) Teacher Technology Leadership a priori Codes

Codes	Definitions	Exemplary Data	Questions
Teachers Learning with Technology	Educators who are capable of changing their teaching practices to reflect the current trend in technology.	"Then I guess the next thing is just not afraid to try new things when it comes to technology because I mean, like StrataLogica, I guess I hadn't done my part at knowing about this type of stuff because that is such an awesome program, I wonder like Why haven't I seen this before? So, I guess someone who is not afraid to try new things and just always looking for that next big thing because it's just – it's so many resources out there and you're not just going to pop out. You got to go looking for it. You got to experiment and keep looking. You just got to keep looking."	How would you describe a teacher technology leader?

| Teachers Collaborating Around Technology | Teacher technology leaders sharing classroom experiences and discoveries with other professionals. | "We talk a lot. We are like salt and pepper. We pretty much run everything by each other. I'm going to do this in my class. What do you think about this? We tried to integrate as much as possible with her language arts class and my science class to hit up as much as we possibly can."

"He is a technology guru. We are cut from the same piece of cloth. He uses this stuff and it is not unusual, we'll just meet in the hallway over here and we'll just say, I want you to see this. This is something really neat. Watch this. We start just talking back and forth about these things and go our separate ways but we were sharing those ideas back and forth."

"Well, this is what I'm doing in my classroom. You could see this. We share a lot of resources whether its myself or any of the other social studies teachers and like here is what I'm doing. Then I can take it back to my classroom try it or they can take what I've shared and take it to their classroom and try it. It really is a good use of time I think in the school. I think that all of our social studies teachers are more on the same page now than we've ever been." | What are your responsibilities as far as technology usage? |

Teachers Networking in Technology-active Communities	Teacher technology leaders who participate with experts outside the school to solve problems.	"We have had extensive training and cooperative learning and persistent issues in history which we've done in concert with Auburn University.." "So, it's a very collaborative environment, we got a lot of different people doing a lot of really neat things. It would be nice if everybody was doing their own thing but it's so much better when everybody is able to share and say "Hey, look at what I'm doing. Look at what you're doing and let's do some of these things and we can share these things." It just makes it so much better when you got a bunch of people doing different things and you can all bring them together."	Tell me about collaborating with your teachers?
Teachers Contributing to Knowledge about Technology	Educators who wish to add to the body of academic technology literature in order to affect change on schools at large.	"I didn't go with the different teachers who were looking at some of the different school that had already done a one-to-one laptop orientation? But when they did come back in, they were talking about integrating the technology into the classroom and how to develop lessons and some of the different sites that we could use and some of the different software programs that we were going to do, myself along with IT Coach, H1/TTL, M2/TTL, a lot of other teachers that were already technology oriented, they went ahead and used those resources for professional development and we actually presented professional development activities for the rest of the teachers as well."	Were you part of the steering committee?

Emergent Coding

| Action Research | Participants examine and reflect on their own pedagogical practices to solve problems and meet student needs. | "We had a core group of teachers and administrators and district personnel because we certainly would have to have the funding and support for this and began the journey of trying to learn as much about it as we could, researching products available, talking to vendors, looking at how it's been integrated successfully and not and then talking to our students and trying to talk to all of our stakeholders to bring them on board."

"Yeah, I want to say during that time, they were doing a lot of research because they were prepared to make a lot of major changes especially with this technology initiative, the way we grade and all of those different things. So yeah, there was a lot of research behind it. I mean, any time we would do anything, that was the first thing that they would often tell us about the research behind it and all those different things but I can't remember any of those specifics but yeah. I mean I would say definitely there was a lot of that going on." | How did the one-to-one laptop initiative begin? |