TEACHER PERCEPTIONS OF MOVING TOWARD TECHNOLOGY INNOVATION: 
DOES AN ENHANCING EDUCATION THROUGH TECHNOLOGY 
GRANT LEAD TO INNOVATION AND CHANGE? 

by 

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A DISSERTATION 

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ABSTRACT

The purpose of this study was to explore the beliefs and perceptions of teachers participating in a project funded by an EETT grant for technology integration, concentrating on factors that reveal how the implementation of the 21st century hardware and staff development might have changed the atmosphere of their classrooms and teaching practices. The project was implemented by three southern Alabama public school systems that formed a consortium. The goal of the project was to develop a cadre of school-based teaching and learning school technology coordinators acting as technology mentors to help teachers integrate technology into teaching and learning for improving student achievement. This research study followed a qualitative research design; a multi-site case study that included technology coordinators who initiated the EETT grant project proposal and teachers who agreed to participate in the implementation of the project. The theory behind this study revolved around diffusion of innovations, educational change, and the adoption of technology.

In response to the overarching question that guided this study “Does an Enhancing Education through Technology Grant lead to innovation and change?” results showed that the consortium developed between the three systems has led to innovation and change in the selected classrooms. This study identified the levels of use of the participants involved in the 21st century project. Using Rogers’ Diffusion of Innovations Model (2003), 33% of the technology coordinators and teachers were in the Early Adopter category, and 66% in the Early Majority category. The CBAM model (Hall & Hord, 1987) revealed that 3 participants were in the Routine level, 2 participants were in the Refinement level, 3 participants were in the Integration level, and 1
participant was in the Renewal level. The participants involved in the present project expressed an initial desire and willingness to accept change. Results from this study have the potential to guide future 21st century technology implementation into the K-12 classrooms.
DEDICATION

This dissertation is dedicated to my Mother, Patricia Brown. She passed away on July 15, 2003. Her love and support throughout my life have shaped who I am. I miss her daily, and I want to dedicate this dissertation to her.
ACKNOWLEDGMENTS

This endeavor was made possible thanks to the support of many people who never faltered in their support. First, I want to acknowledge my husband, Mike, who loved me, encouraged me, believed in me, and who took on so many responsibilities to allow me to devote my time and energy to finishing this dissertation. His love and support have been invaluable during this process. I am so blessed to have the love and support of my two beautiful girls, Tessa and Trista. They missed out on so much time with me at home to allow me to reach this ultimate goal. I want to thank my Daddy, who has expressed his continual pride in my accomplishments while loving me and never giving up on me. Next, my gratitude to my dissertation chair, Dr. Margaret Rice, who has provided so much guidance and support throughout this process. I would also like to thank the members of my dissertation committee, Dr. Wright, Dr. Benson, Dr. Fowler, and Dr. Newton whose teaching and guidance allowed me to get to this level.
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CHAPTER I:
INTRODUCTION

Educational reform has been a goal of the U.S. federal government since the late 1950s through today because the goal was to get innovations into education, as if flooding the system with external ideas would bring about desired improvements (Fullan, 2007). Many educators and policy makers believe that technology can be a catalyst for educational reform (Collins, 1991; Means, Olson, & Singh, 1995; Mehlinger, 1996; Newman, 1992; Sheingold, 1991). The integration of educational technology facilitates changes in teaching and learning and is increasingly viewed as an agent of change linked to attempts at reform in K-12 schools today (Apple Classrooms of Tomorrow, 1998; U. S. Department of Education, 2003). The changes that technology integration enables are considered transformational in nature and impact the beliefs, perceptions, and practices of teachers and educational institutions. These transformational changes include learning environments moving from teacher-centered instruction to student-centered learning; from teachers working in isolation of individual classrooms to teachers collaborating with colleagues across distances; from students as passive individual learners to active learners working in teams collaboratively; and from schools isolated from society to schools integrated into society (CEO Forum 2000, 2001; International Society of Technology Education, 2007, 2008; Kozma, 2003; North Central Regional Educational Laboratory, 2000; Sandholtz, Ringstaff, & Dwyer, 1997).

The last two decades of research and practice have promised benefits of this transformative nature of educational technology that have often failed to materialize and there has been an increased understanding of the complexity of integrating educational technology into teaching and learning (Bennet, McMillan, Honey, Tally, & Spielvogel, 2000; Cuban, 2001). The complexity involved in integrating technology into the curriculum requires extensive research into the factors that act as facilitators of effective technology integration, which not only introduce concepts and practices that
require changes to several traditional educational models, but also challenge the validity of past teaching practices. Research has identified the most common factors that act as facilitators of educational technology integration as access to the technology, technical assistance, professional development, and time to develop authentic uses of educational technology in the classroom (U.S. Department of Education, 2000a). The successful integration of technology goes beyond these basic requirements and necessitates looking at technology in the context of the school setting as well as understanding the change process which shows educators exhibiting a commitment and ownership in the change; using a systems thinking approach in implementing technologies; sustained staff development; a regard for the contextual factors in the classroom; an awareness of the cultural implications of the implementation; shared leadership among educators; building communities of practice; and an appreciation for the pedagogical and philosophical beliefs of teachers (Fullan, 2007; Guskey, 1986; Knezek & Christensen, 2001; Kozma, 2003; Lambert, 1998, 2002; Wenger, McDermott, & Snyder, 2002).

This study describes a project implemented by three southern Alabama public school systems. The three systems formed a consortium. The goal of the project was to develop a cadre of school-based teaching and learning school technology coordinators to act as technology mentors to teachers at their schools to integrate technology into teaching and learning to improve student achievement.

Statement of the Problem

Many schools in the United States have not harnessed the potential of technology as a pedagogical tool. While the equipment may be available in the classrooms, it does not mean the hardware is being used efficiently. A national survey revealed that only 27% of all teachers use computers in 20 or more lessons during the school year; further, the degree of integration occurring may differ across subject areas with social studies and math teachers using computers less frequently in the classroom (Becker, 2001). In a national survey by the National Educational Association
(2008), most educators used technology regularly at school for administrative tasks (76%), but substantially fewer used it for instruction-related tasks (32%). The Technology in Alabama Public Schools report (2006) stated that there are 51,311 classrooms in the state of Alabama and 3,613 are not even equipped with one computer, much less the technology tools needed for today’s classroom teaching. Results in the Technology in Alabama Public Schools report (2006) stated that 55% of teachers seldom or never teach students to select and apply suitable productivity tools to complete personal and educational tasks. On the national level, the National Center for Education Statistics (NCES) (2000, 2005) reported that only one-third of teachers reported feeling “well prepared” to infuse technology within the classroom. Leu (2000) reported that 80% of the nation’s K-12 teachers did not feel adequately prepared to use technology in their classrooms. According to a national survey by CDW-G (2005), 75.5% of teachers surveyed cited value in using technology to teach, but only 54% actually use it daily. In the same survey, 26.1% of teachers strongly agreed that technology was a teaching tool that could improve student academic performance.

The No Child Left Behind Act (NCLB) of 2002 calls for the increase in accountability tied to standardized testing, greater flexibility for schools, more choices for parents and students, and using research to guide instruction (U. S. Department of Education, 2002). The Enhancing Education Through Technology program (ETTT) (Title II, Part D, of NCLB) is the Department’s only program dedicated to the integration of educational technology in K-12 schools. EETT explicitly supported the broad goals of NCLB through the use of technology in schools. The primary goal of the program was to improve student academic achievement in elementary and secondary schools through the use of educational technology. Section 2402 of the Title II legislation also details two additional goals for EETT:

1) To assist every student in crossing the digital divide by ensuring that every student is technologically literate by the time the student finishes the eighth grade, regardless of the student’s race, ethnicity, gender, family income, geographic location, or disability. Determining if a student is technologically literate normally takes the form of a test given at the end of the student’s eighth grade school year to determine technological literacy.
2) To encourage the effective integration of technology resources and systems with teacher training and curriculum development to establish research-based instructional methods that can be widely implemented as best practices by state education agencies and local education agencies.

Preparing our students to be productive in the 21st century does not mean teaching our students the basic curriculum and how to use computers associated with basic literacy. Educational reform from the NCLB Act of 2002 has initiated the need to change our present educational goals to include 21st century learning if we are to compete globally in the future. Changes in economic, technological, information, demographic and political forces have transformed the way we work and live. Schools, businesses, communities, and families must adapt to this change to thrive. “Today’s education system faces irrelevance unless we bridge the gap between how students live and how they learn” (Partnership for 21st Century Skills, 2003, p. 3). Schools are struggling to keep up the pace with new technologies introduced on a daily basis typically adopted first by industry and business. Unfortunately, the classrooms receive technology months or even years behind industry and business. Apple Classrooms of Tomorrow-Today: Learning in the 21st Century (2008) stated,

The profound changes require schools to become more than information repositories; they must also be places where students can acquire knowledge and skills they can use to solve complex problems for the rest of their lives. These changes affect the role of educators even more dramatically. Educators must become more than information experts; they must also be collaborators in learning—leveraging the power of students, seeking new knowledge alongside students, and modeling positive habits of mind and new ways of thinking and learning. (p. 8)

Statement of Purpose

The purpose of this study was to explore the beliefs and perceptions of teachers in the project funded by an EETT grant for technology integration concentrating on factors that reveal how the implementation of the 21st century hardware and staff development might have changed the atmosphere of their classrooms and teaching practices. The 21st Century Project modeled its project after the IMPACT model from North Carolina (North Carolina Department of Instruction, 2000a). This study sought to explain teachers’ acceptance of technology integration as an innovation, identify
factors that teachers feel have shaped them into becoming technology integrators, and note identifiable changes in their own teaching practices. The theory behind this study revolved around diffusion of innovations, educational change, and the adoption of technology. Implementing change regarding technology integration is not a one step process but requires planning, organization, and research-based theories.

Significance of the Problem

Marcinkiewicz (1993) offered that there is a need to study the aspects of computer technology that encourage its use for education and also study the teachers in order to determine what makes them want or need to use computer technology. In the 21st century, we began to see a major paradigm shift in instructional methods to reflect the challenges present in today’s society. For a student to be competitive in a global market, we can no longer rely simply on traditional educational strategies. To meet these demands, we must supplement and/or replace traditional methods of instruction with innovative educational experiences. Some strategies include cooperative, discovery, and inquiry learning activities; however, to facilitate these methods in innovative and true-life situations that match their everyday life outside of school, educators must implement technology in the learning environment. Technology and multimedia applications should be used as a tool to enhance a child’s educational experience by creating a variety of methods to meet special needs, to teach, to manage information, and to allow for opportunities to develop higher level thinking skills.

Educational reform to prepare students in the 21st century is important because today’s student will require new abilities to thrive in the future. Not surprisingly, students today expect to learn in an environment that mirrors their lives and their futures—one that seamlessly integrates today’s digital tools, accommodates a mobile lifestyle, and encourages collaboration and teamwork in physical and virtual spaces. The disconnect between a student’s digital life and school matters because students learn better when they are engaged, and research about what engages them points to
technology (America’s Digital Schools, 2006). Students who have access to technology outside of school will find schools without the technology to be antiquated and irrelevant to their world. “The current and future health of America’s 21st Century Economy depends directly on how broadly and deeply Americans reach a new level of literacy—21st Century Literacy—that includes strong academic skills, thinking, reasoning, teamwork skills, and proficiency in using technology” (National Alliance of Business, 2000, p. 9). The results of this study about innovation and change and teacher perceptions regarding integration of technology could help guide systems, schools, and teachers in implementing future reform initiatives.

Research Questions

The research questions that guided the study include

1) What are the teacher perceptions of innovation and change regarding technology integration?;

2) How has the technology supplied with the grant changed the classroom atmosphere?;

and

3) How has the staff development provided with the project encouraged teachers to collaborate and become part of a professional community?

Assumptions of the Study

The assumptions for the study were as follows:

1) The assumptions and characteristics of the case study defined the nature of the research process and allowed the researcher to learn more about the study participants and how they perceived the integration of technology as a change agent;

2) The participants responded voluntarily without influence from the researcher; and

3) The participants answered honestly based on their knowledge, understanding, and experience.
Limitations of the Study

Possible limitations associated with the case study were as follows:

1) Primary data were collected from self-reporting via guided interviews and open-ended inquiries of participants;

2) Teacher participants were limited to educators whose classrooms received the equipment specified by the grant;

3) Data were collected from a focused sampling within the three systems. Therefore, the final product is not necessarily generalizable to other systems;

4) Replication may not be possible; and

5) Reporting bias may reflect the researcher’s perception of outcomes.

Definition of Terms

*Barrier* - Something immaterial that obstructs or impedes or something that separates or holds apart (The American Heritage dictionary, 2009).

*Capacity Building* - “…is multifaceted because it involves everything you do that affects new knowledge, skills, and competencies; enhanced resources; and stronger commitments” (Fullan, 2007, p. 252).

*Change Agent* - “An individual who influences clients’ innovation-decisions in a direction deemed desirable by a change agency” (Rogers, 2003, p. 27).

*Change Capacity* - “The collective ability to make change happen based on new knowledge, new resources and new commitments or motivation” (Fullan, 2004, p. 15).

*Change Knowledge* - “Knowledge about how change occurs and the key drivers that cause change” (Fullan, 2004, p. 15).

*Change Processes* - “Understanding the dynamics of change as it unfolds in a situation, including insights into how to manage change” (Fullan, 2004, p. 15).
Educational technology - “…is a more specific domain of instructional technology. It is a combination of the processes and tools involved in addressing educational needs and problems, with an emphasis on applying the most current tools: computers and their related technologies” (Roblyer & Edwards, 2000, p. G-3).

Innovation - “…the content of a given new program” (Fullan, 2007, p. 11); “An idea, practice, or object that is perceived as new by an individual or other unit of adoption” (Rogers, 2003, p. 12).

Innovation-Decision Process - “The process through which an individual (or other decision-making unit) passes from first knowledge of an innovation to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation and use of the new idea, and to confirmation of this decision” (Rogers, 2003, p. 20).

Innovation-Development Process - “All the decisions, activities, and their impacts that occur from recognition of a need or problem, through research, development, and commercialization of an innovation, through diffusion and adoption of the innovation by users, to its consequences” (Rogers, 2003, p. 137).

Innovativeness - “…the capacities of an organization to engage in continuous improvement” (Fullan, 2007, p. 11).

Instructional technology - Educational technology that deals directly with teaching and learning applications (Roblyer, 2006).

Integrate - To make whole or to renew; to integrate technology into education that will cause school change and improvement; implies that schooling will change, and that as a result, it will improve (Kinnaman, 1994).

Leadership - “Leaders focus on individuals. Leadership involves developing leadership throughout the system. It involves the capacity to lead change, and to develop others so that there is a critical mass of people working together to establish new ways” (Fullan, 2004, p. 15).
Leadership Capacity - “…an organizational concept that refers to the organization’s capacity to lead itself and sustain that effort when key individuals leave. It requires a significant number of skilled individuals who understand the shared vision of the school, the scope of the work underway and who are capable of carrying it out” (Lambert, 2002, p. 38).

Moral Purpose - “The human desirability of a goal; in education moral purpose often involves raising the bar and closing the gap of student learning in the society as a whole” (Fullan, 2004, p. 15).

Professional Learning Community - Groups or teams interested in ensuring that students learn, work in a culture of collaboration, and focus on results (DuFour, 2004).

Shared Leadership - Operating in ways that build shared commitment, collective skills, and coordination strategies (Hackman, 2002).

Shared Meaning - “…it involves simultaneously individual and social change” (Fullan, 2007, p. 11).

Social Change - The process by which alteration occurs in the structure and functions of a social system (Rogers, 2003).

Social System - A set of interrelated units involved in joint problem solving to accomplish a common goal (Rogers, 2003).

Staff Development/Professional Development - “The sum total of formal and informal learning experiences throughout one’s career from preservice teacher education to retirement” (Fullan, 1991, p. 326).

Technology - Technology is commonly thought of in terms of gadgets, instruments, machines and devices (Muffoletto, 1994).

Technology Integration - Technology integration is the incorporation of technology resources and technology-based practices into daily routines, work and management of schools. Technology resources are computers and specialized software, network-based communication systems, and other equipment and infrastructure. Practices include collaborative work and communication, Internet-based research, remote access to instrumentation, network-based transmission and retrieval of data,
and other methods…. It is important that the integration be routine, seamless, and both efficient and effective in supporting school goals and purposes (National Center for Education Statistics (NCES), 2002).

Vision/shared vision - People stimulate, inspire, and motivate each other in a shared commitment to contribute and implement best ideas, and best ideas mean greater overall coherence. (Fullan, 2001).

Summary

This dissertation contains five chapters: Introduction; Review of Literature; Methods; Results; and Discussion, Conclusions and Recommendations. Chapter I was a summary of the existing literature surrounding school change and technology integration. This chapter also includes the statement of the problem, statement of purpose, significance of the problem, research questions, assumptions of the study, limitations of the study, and the operational definition of terms. Chapter II contains the extensive literature review surrounding technology, models of change and innovation in education, and factors influencing the adoption of innovations. Chapter III contains the methods of the study including setting of the study, participants, instrumentation, data collection, data analysis, validity and reliability, and the researcher positionality. Chapter IV contains the results of the study. Chapter IV contains the discussions, conclusions and the recommendations.
CHAPTER II: REVIEW OF THE LITERATURE

Introduction

Chapter II builds the contextual framework for this study by incorporating relevant research and theories that are key sources for understanding the topic of this study. It contains two major sections: technology and models of change and innovation in education.

The technology section provides an understanding of the contextual factors that best support the integration of educational technology as an innovation that requires deep changes in every aspect of the system, school, and faculty perceptions. The technology section contains additional descriptive sections including: technology implementation, learning in the 21st century, and the North Carolina IMPACT Model. The models of change and innovation in education section contain types of change, models of innovation, and factors influencing the adoption of innovations.

Educational technology is viewed as an agent of change and as an innovation that is linked to school improvement, reform, and restructuring. The technology section discusses related literature that considers the types of changes reported in previous literature that are associated with the integration of educational technology as well as the complexity surrounding the conditions necessary to support its successful implementation.

Technology Implementation

The Apple Classrooms of Tomorrow research project that began in 1985 sought to study how the use of technology routinely by teachers and students might affect teaching and learning. The main question asked in this study was what could happen when students and teachers had constant access to technology (Apple Classrooms of Tomorrow [ACOT], 1998). After more than a decade of research, the ACOT project demonstrated that technology not only increases the potential for learning, but that the use of technology brought about changes in teaching and learning (ACOT, 1998). The insights gathered and evaluated for over thirteen years laid the ground work for
technology to be viewed as a catalyst for change and information technology as a vehicle for changing the structure of the traditional classroom (ACOT, 1998; Dwyer, 1994; Holvig & Crisci, 2001).

Reports on K-12 technology integration from 1983 to 2003 have shown that technology is a catalyst for changes in the content, methods, and overall quality of the teaching and learning process (U.S. Department of Education, 2003). *A Retrospective on Twenty Years of Educational Policy* noted that, in 1995, policy reports began to identify educational technology as a driver of school reform that had the potential to become a tool of transformation which could cause changes in “how teachers teach, how schools are organized, and how students work together and learn” (U.S. Department of Education, 2003, p. 20).

*Learning in the 21st Century*

The ultimate goal of education is to prepare students to be productive citizens in today’s society. Schools are struggling to keep pace with the astonishing rate of change in students’ lives outside of the school. Students will spend their adult lives in a multitasking, multifaceted, technology-driven, diverse, vibrant world—and they must arrive equipped to do so. We also must commit to ensuring that all students have equal access to this new technological world, regardless of their economic background (Partnership for 21st Century Skills, 2003).

The 70 million people born between 1982 and 2000 live in a world that is dramatically more complex than it was just a few years ago. In a short period of time, the world and its people, economies and cultures have become inextricably connected, driven largely by the Internet, innovations in mobile computers and devices, and low-cost telecommunications technology (Apple Classrooms of Tomorrow—Today, 2008).

Educating young people to be successful in this changing world is no small task, but the option of failure is not acceptable. Current data show that high school graduates in jobs requiring the highest degree of innovative thinking earn more than 50 percent more than those in jobs requiring the
least innovation. For college graduates, the difference is 135 percent (Uhalde, 2006). A parallel
trend shows that our current practice of outsourcing jobs to countries such as China and India is
making it more difficult for unskilled American workers to earn middle-class incomes (Yankelovich,
2005). Engaging students in this generation requires teaching methods to be changed.

Students today have grown up in a world where mobile computers, cell phones with
browsers, and other personal digital devices are common tools, and instant messaging, blogs,
and wikis are common modes of self-expression. All together, students spend an average of
nearly 6.5 hours a day with media. (Jenkins, 2006, in Apple classrooms of tomorrow—today,
p.8)

Students of today are digital natives and feel very comfortable with the new technologies available
on a daily basis. Cell phones and other digital devices are often forbidden at school. Traditional
classrooms with teacher-led instruction, textbooks, paper and pencil often fail to motivate and engage
students in today’s society.

According to the 2005 Pew Internet & American Life Project, 87 percent of 12- to 17-year-olds—or 21 million young people—are Internet users, an increase of 24 percent from 2000. Three-quarters of today’s teens use at least two digital devices daily. Students routinely
observe adults in professions and workplaces enabled by the same technologies and tools
they use in their own daily lives. Because of today’s digital technology, students live a media
rich, connected, and mobile lifestyle, and they are just as often producers of content as they
are consumers. Web 2.0 technologies, including social networks and participatory sites such
as YouTube, MySpace, Second Life, and World of Warcraft, provide them with engaging
opportunities for interaction and informal learning, and create new opportunities to leverage
this informal learning by integrating it purposefully into the fabric of formal learning.
(Larson & Walker, 2006 in Apple classrooms of tomorrow—today, p. 8)

Students today expect to learn in an environment that mirrors their lives—one that seamlessly
integrates today’s digital tools, accommodates a mobile lifestyle, and encourages collaboration and
teamwork in physical and virtual spaces. The disconnect between a student’s digital life and school
matters because students learn better when they are engaged, and research about what engages them
points to technology (America’s digital schools 2006-A five-year forecast, Mobilizing the
curriculum, 2006). The Alabama Classroom Technology Initiative recommend that the existing
learning environment must change and be replaced by a learning environment where all students,
staff, and administrators have access to the technologies, tools, and skills to support seamless, interactive learning (AETA, n.d.).

Table 1 indicates the paradigm shift that must occur in order to meet the essential conditions of technology infused learning environments (ISTE, 2007).

Table 1.

*Technology Infused Learning Environments*

<table>
<thead>
<tr>
<th>Traditional</th>
<th>Incorporating New Strategies</th>
<th>New Environments</th>
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<tr>
<td>Teacher-centered instruction</td>
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<td>Learner-centered environments</td>
</tr>
<tr>
<td>Single sense stimulation</td>
<td>=⇒</td>
<td>Multisensory stimulation</td>
</tr>
<tr>
<td>Single media</td>
<td>=⇒</td>
<td>Multimedia Hypermedia</td>
</tr>
<tr>
<td>Isolated work</td>
<td>=⇒</td>
<td>Collaborative work</td>
</tr>
<tr>
<td>Information delivery</td>
<td>=⇒</td>
<td>Information exchange, publication, creation</td>
</tr>
<tr>
<td>Passive learning</td>
<td>=⇒</td>
<td>Active/exploratory/inquiry-based learning</td>
</tr>
<tr>
<td>Factual/literal thinking</td>
<td>=⇒</td>
<td>Critical thinking, informed decision-making</td>
</tr>
<tr>
<td>Reactive response</td>
<td>=⇒</td>
<td>Proactive/planned action</td>
</tr>
<tr>
<td>Isolated, artificial context</td>
<td>=⇒</td>
<td>Authentic, real world context</td>
</tr>
</tbody>
</table>

(ISTE, 2007, retrieved from http://www.nectec.or.th/users/htk/it-education/)

According to the Apple Classroom of Tomorrow—Today (2008) report, the “21st century learning is at the confluence of three major influences: globalization, which increases global interdependence and competition; technology innovations that enable more engaged teaching and learning and provide 24 by 7 access to content and people; and new research on how people learn” (p. 9). Globalization has been affected by technology in allowing 24/7 markets that extend across
every time zone. International commerce is important to the American economy and U.S. economic
growth. Job outsourcing to countries like India and China have taken away jobs from many workers
inside the U.S. (Yankelovich, 2005). Technology innovations have allowed instant availability to
information from numerous sources, which allows students to have direct access to the building
blocks of their future knowledge. The importance of research for educators is that it reveals how
students today learn best.

North Carolina IMPACT Model

The IMPACT model in North Carolina was funded by the technology component of the No
Child Left Behind federal program (NCLB) that provides funding for technology to aid high-need
students in schools across the nation. The three goals of NCLB Title II Part D as stated in Section
2404 of the NCLB Title II Part D law are listed below (SETDA National Trends Report, 2008):

1) PRIMARY GOAL- The primary goal of this part is to improve student academic
achievement through the use of technology in elementary schools and secondary schools.

2) ADDITIONAL GOALS- The additional goals of this part are the following:
   A) To assist every student in crossing the digital divide by ensuring that every student is
      technologically literate by the time the student finishes the eighth grade, regardless of the
      student's race, ethnicity, gender, family income, geographic location, or disability.
   B) To encourage the effective integration of technology resources and systems with
      teacher training and curriculum development to establish research-based instructional
      methods that can be widely implemented as best practices by State educational agencies
      and local educational agencies. (SETDA National Trends Report, 2008, p. 1)

The North Carolina Department of Public Instruction developed a plan outlining standards
for instructional technology implementation, which addresses all of the components for a successful
program. Impact: Guidelines for School Library Media & Instructional Technology Programs
provides standards for school personnel to follow in implementing a plan for successful technology
integration. The standards are based on national, state, and professional standards for programs,
personnel, budgets, resources and facilities to help build a technology rich educational environment.
The project being studied in this dissertation was modeled after the North Carolina IMPACT model.
The IMPACT model stresses: IMPACT Teaching, IMPACT Learning; IMPACT Motivation, and IMPACT Student Achievement (North Carolina Department of Public Instruction, 2000a) (see Figure 1).

Figure 1. IMPACT model of technology integration (Steelman, Vasu, & Foley (2004).

Models of Change and Innovation in Education

Educational change involves change in practice. Innovations are often multidimensional. Change can be categorized into different types, and it is a process that includes many stages or levels of diffusion in adopting an innovation. Different researchers have described these stages in different terminology. Similarities between the change models often overlap and represent the same ideas.

First and Second Order Barriers

Different barriers can prevent educational change, and they are often broken down into first and second order barriers. Ertmer (1999) defined first order barriers as those obstacles that are extrinsic to teachers and include lack of access to computers and software, insufficient time to plan
instruction, and inadequate technical and administrative support. Second order barriers are intrinsic to teachers and include beliefs about teaching, beliefs about computers, established classroom practices, and unwillingness to change. Adding additional resources or providing computer-skills training can eliminate first order barriers. Confronting second-order barriers requires challenging one’s belief system and comfortable routines of one’s practice.

According to Cuban (2001), educational technology that has been implemented as a first order change has not produced fundamental changes in teaching and learning. Technology training has traditionally focused on helping teachers overcome first order barriers (Ertmer, 1999). Educational technology integration is a second order change and recognizing this distinction deepens the understanding of the impact on a school system and the types of leadership practices and strategies that are appropriate. Training programs have started to focus on pedagogical models of technology use as one means of addressing second order barriers (Ertmer, 1999). Second order changes requires leaders to work far more deeply with staff and the community, establish agreement on the purposes of the proposed change, and develop a shared vision of its possibilities (Waters, Marzano, & McNulty, 2003). Achieving meaningful technology use is a slow process that is influenced by first and second order barriers. When determining reasons why teachers are struggling to use technology effectively, it may be important to look at what they exhibit in terms of beliefs and practices in addition to what they do not have in equipment. First order barriers can be more readily observed and more easily addressed, second-order barriers are likely to be more persistent and require major changes in daily routines and underlying beliefs about effective practice (Ertmer, Addison, Lane, Ross, & Woods, 1999).

Dimensions of Educational Change

There are at least three components or dimensions when implementing any new program or policy: (a) the possible use of new or revised materials such as curriculum materials or technologies, (b) the possible uses of new teaching approaches, and (c) the possible alteration of beliefs.
Understanding change leads to the adoption of the innovation (Fullan, 2005, 2007). The engagement of moral purpose for educators leads to the fundamental belief that what is valuable for children and educators is the ownership of the desired change. An important factor in a technology project’s ultimate success may hinge on whether teachers believe that the innovation will benefit their students and how they see themselves playing a role in realizing those benefits. Perceptions of the people involved in the change process are more positive if they are aware of the process, and they are less likely to resist the change. Capacity building is a crucial aspect of the change process, which includes shared identity or collaboration with parents, students, teachers, and administrators. Those involved in the change process are mutual learners and leaders who share a vision of how the project works in order to achieve the desired outcomes.

Models of Innovation

The adoption of an innovation is a process (Rogers, 1995, 2003). This process is also true in education (ACOT, 1998; CEO Forum, 1999; Fullan, 1991, 2007; Hall & Hord, 1987, Hord, Rutherford, Huling-Austin, & Hall, 1987, 2006; Hooper & Reiber, 1995; Marcinkiewicz, 1993; Moerch, 2002; Sandholz & Ringstaff, 1996; Sherry, Billig, Tavalin, & Gibson, 2000). Models of innovation generally show the innovators moving through stages. These stages progress from nonuse to evolution. Next, there is usually initial use or awareness or orientation, which many theorists describe as mechanical or supportive of practices. This is followed by integration or confirmation, where use of the innovation leads to some change in existing practices to do things that were not possible before, and finally to some sort of evolution or outcome where new uses for the innovation are discovered or new innovations sought. Several major models of diffusion of innovations will be discussed. Table 2 outlines seven major models of change and the stages of use for each model.
Table 2.

Models of Change

<table>
<thead>
<tr>
<th>Theorist</th>
<th>Rogers</th>
<th>Hall &amp; Hord (CBAM)</th>
<th>Fullan</th>
<th>Marcinkiewicz; Hooper &amp; Rieber</th>
<th>Sherry, Billig, Tavalin &amp; Gibson</th>
<th>Sandholz &amp; Ringstaff, CEO Forum</th>
<th>Moerch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Theory</td>
<td>General Theory</td>
<td>Education</td>
<td>Education</td>
<td>Technology in Education</td>
<td>Technology in Education</td>
<td>Technology in Education</td>
<td>Technology in Education</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stages of Use</th>
<th>Knowledge</th>
<th>Nonuse</th>
<th>Initiation</th>
<th>Nonuse Familiarization</th>
<th>Teacher as Learner</th>
<th>Entry</th>
<th>Nonuse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Gathering</td>
<td>Persuasion</td>
<td>Orientation Preparation</td>
<td></td>
<td></td>
<td>Teacher as Adopter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial Use</td>
<td>Decision</td>
<td>Mechanical Use</td>
<td>Implementation</td>
<td>Utilization</td>
<td>Teacher as Co-learner</td>
<td></td>
<td>Adoption</td>
</tr>
<tr>
<td>Implementation</td>
<td>Routine Use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Exploration</td>
</tr>
<tr>
<td>Adaptation</td>
<td>Confirmation</td>
<td>Refinement Integration</td>
<td>Continuation</td>
<td>Reorientation</td>
<td>Teacher as Reaffirmer or Rejecter</td>
<td>Adaptation</td>
<td>Infusion</td>
</tr>
<tr>
<td>Rerevaluation</td>
<td>Renewal</td>
<td></td>
<td></td>
<td></td>
<td>Teacher as Leader</td>
<td></td>
<td>Invention</td>
</tr>
</tbody>
</table>

(CEO Forum, 2000; Fullan, 2007; Hall & Hord, 1987; Hooper & Rieber, 1995; Marcinkiewicz, 1993; Moerch, 2002; Rogers, 2003; Sandholtz & Ringstaff, 1996; Sherry, Billig, Tavalin, & Gibson, 2000)
Rogers (1995), in *Diffusion of Innovations*, detailed a five-stage innovation diffusion theory whereby an individual may achieve knowledge, change attitude, and embrace actions toward using a new technology. The first stage, or “knowledge” stage, occurs when teachers are not technology users but are aware that it exists. At this stage, students may be users of technology, but they use it in ways determined by someone other than the education system. Students of today are surrounded daily with the use of technology outside the school walls. The second stage, or “persuasion” stage, occurs when teachers are making their first interpersonal contacts with peers who they will tend to emulate and gain new information from about the technology. Examples of this stage occur daily in today’s technological society with the use of cell phones, gaming systems, and digital devices. The third stage, or “decision” stage, occurs when the teacher chooses to accept or reject the new changes. Teachers’ acceptance of the change begins the process of adopting technology to assist with traditional tasks and adapting the technological changes to enrich their curriculum. Technology can be seen as actually connecting with the curriculum. At the fourth stage, or “implementation” stage, teachers move from adaptation to an appropriation stage where technology is viewed as a relevant tool for teaching and learning. Teachers may begin to design learning experiences and environments involving technology that will assist in achieving objectives and outcomes. A shift toward student-directed integration occurs at this stage to produce improvements in learning that allow students to master higher-order thinking skills, complex concepts, and skills they may not have otherwise encountered without technology. In the final stage, or “confirmation” stage, teachers redefine the classroom environment and leverage technology to engage students in tasks involving critical thinking, organizational skills, and mastery of content. Teachers not only begin to invent new ways to use technology, but they also collaborate with other teachers to create a unified vision of using technology across the curriculum. Uncertainty also implies a lack of predictability, of structure, of information. The Concerns Based Adoption Model (CBAM) and the diffusion model rely on understanding the change process as an important part of accepting the innovation.
Hall and Hord (1987), primarily to understand the point-of-view of potential adopters, developed the Concerns Based Adoption Model (CBAM). The Concerns-Based Adoption Model (CBAM) is a conceptual framework that describes, explains, and predicts probable teacher concerns and behaviors throughout the school change process. The three principal diagnostic dimensions of CBAM are as follows:

1) Stages of Concern (SoC): Seven different stages of feelings and perceptions that educators experience when they are implementing a new program or practice;

2) Levels of Use (LoU): Eight behavioral profiles that describe a different set of actions and behaviors that educators engage in as they become more familiar with and more skilled in using an innovation or adopting a change; and

3) Innovation Configurations (IC): Different ways an innovation may be implemented, shown along a continuum from ideal implementation or practice to least desirable practice.

The CBAM dimensions – SoC, LoU, and IC – give evaluators, researchers, and administrators’ flexible tools that they can use to begin to assess, monitor, and better understand aspects of the implementation process. The SoC and the LoU both focus on the individual, while the IC dimension helps everyone evaluating or involved in the change process to understand what constitutes the ideal in terms of the new innovation, strategy, or program and to anticipate the variety and diversity of how individuals may implement it (Hord, Steigelbauer, Hall, & George, 2006). Horsley and Loucks-Horsley (1998) stated, “CBAM has proven itself an indispensable tool for developing and continually evaluating reform efforts, one that ought to be in every professional developer’s toolkit” (p. 17). One of the greatest strengths of the CBAM model is that it gives credence to, and supplies a precise language for the feelings of each of us when a change or innovation is introduced into our everyday lives (Horsley & Loucks-Horsley, 1998).

The North Carolina IMPACT model requires that the CBAM stages of concern be identified and monitored throughout the implementation process of the model. Once the stages of concern are
identified, the leaders of the program can more easily communicate the needs of both the teacher and
the program. Table 3 presents the stages of concern and possible expressions of the stages of concern
in the CBAM model and the levels of use of innovations and typical behaviors.

Table 3.

*Stages of Concern*

<table>
<thead>
<tr>
<th>Stage of Concern</th>
<th>Expression of Concern</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. Refocusing</td>
<td>I have some ideas about something that would work even better.</td>
</tr>
<tr>
<td>5. Collaboration</td>
<td>How can I relate what I am doing to what others are doing?</td>
</tr>
<tr>
<td>4. Consequence</td>
<td>How is my use affecting learners? How can I refine it to have more impact?</td>
</tr>
<tr>
<td>3. Management</td>
<td>I seem to be spending all my time getting materials ready.</td>
</tr>
<tr>
<td>2. Personal</td>
<td>How will using it affect me?</td>
</tr>
<tr>
<td>1. Informational</td>
<td>I would like to know more about it.</td>
</tr>
<tr>
<td>0. Awareness</td>
<td>I am not concerned about it.</td>
</tr>
</tbody>
</table>

(Hord, Rutherford, Huling-Austin, & Hall, 1987)

The first three stages of concern are primarily associated with individual discovery of the
specific innovation or idea. The first three stages are generally exploratory. The management stage
focuses on mastery, but there still may not have been a “buy-in” at this point. The final three stages
focus primarily on the results or impact of the idea or innovation. At these stages, the potential
adopter will accept or abandon the idea or innovation, or possibly reinvent its use. The level of use
cart in Table 4 helps categorize adopters according to levels of technology use.
Table 4.

Levels of Use/Behavioral Indicators of Level/Descriptions of Use

<table>
<thead>
<tr>
<th>Levels of Use</th>
<th>Behavioral Indicators of Level</th>
<th>Description of Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>VI. Renewal</td>
<td>The user is seeking more effective alternatives to the established use of the innovation.</td>
<td>A teacher extends an innovation, transforming the innovation.</td>
</tr>
<tr>
<td>V. Integration</td>
<td>The user is making deliberate efforts to coordinate with others in using the innovation.</td>
<td>A teacher goes beyond his or her own classroom to share his or her implementation of an innovation with peers.</td>
</tr>
<tr>
<td>IVB. Refinement</td>
<td>The user is making changes to increase outcomes.</td>
<td>A teacher changes the innovation to suit his or her needs.</td>
</tr>
<tr>
<td>IVA. Routine</td>
<td>The user is making few or no changes and has an established pattern of use.</td>
<td>A teacher successfully integrates an innovation.</td>
</tr>
<tr>
<td>III. Mechanical</td>
<td>The user is making changes to better organize use of the innovation.</td>
<td>A teacher begins implementation but generally struggles with logistics of the innovation.</td>
</tr>
<tr>
<td>II. Preparation</td>
<td>The user has definite plans to begin using the innovation.</td>
<td>A teacher gets ready to include an innovation (but has not yet implemented it).</td>
</tr>
<tr>
<td>OI. Orientation</td>
<td>The user is taking the initiative to learn more about the innovation.</td>
<td>A teacher is seeking additional information about an innovation but has not determined whether he or she will implement it.</td>
</tr>
<tr>
<td>O. Non-use</td>
<td>The user has no interest, is taking no action.</td>
<td>A teacher does not use or has no intentions to use an innovation.</td>
</tr>
</tbody>
</table>

(Anderson, 1997; Hord, Rutherford, Huling-Austin, & Hall, 1987)

Hall and Hord (2006) developed twelve principles of change that can be an impetus for external or internal change. Table 5 lists the twelve principles of change developed by Hall and Hord (pp. 4-14).
Table 5.

Twelve Principles of Change

<table>
<thead>
<tr>
<th>Name/Number</th>
<th>Principle</th>
<th>Application to Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change Principle 1</td>
<td>Change is a process, not an event.</td>
<td>A one-time introduction to a new technology will not cause change. Change is a process in which people and organizations move as they gradually come to understand and become skilled and competent in the use of new ways.</td>
</tr>
<tr>
<td>Change Principle 2</td>
<td>There are significant differences in what is entailed in development and implementation of an innovation.</td>
<td>Development includes all of the steps and actions involved in creating, testing, and packaging a new technology. Implementation includes all of the steps and actions involved in learning how to use the technology. Development and implementation need to be balanced in time and effort for a change to occur.</td>
</tr>
<tr>
<td>Change Principle 3</td>
<td>An organization does not change until the individuals within it change.</td>
<td>As technology is introduced into an organization, successful change starts and ends at the individual level. The more individuals that accept the technological change, the easier it will be for the entire organization to accept the change.</td>
</tr>
<tr>
<td>Change Principle 4</td>
<td>Innovations come in different sizes.</td>
<td>Technology is characterized as a product when implementing new hardware, while integrating technology could be characterized as a process such as affecting a teaching method. Integration of technology can also be broken down into smaller innovations, which may take longer to change.</td>
</tr>
<tr>
<td>Change Principle 5</td>
<td>Interventions are the actions and events that are key to the success of the change process.</td>
<td>As people plan and lead a change process such as technology integration, they tend to be preoccupied with the technology and its use. They often do not think about the various actions and events that they and others take to influence the process, which are called interventions.</td>
</tr>
<tr>
<td>Change Principle 6</td>
<td>There will be no change in outcomes until new practices are implemented.</td>
<td>Often when a change is introduced such as technology integration, the desired goal of having teachers and students use the technology successfully can be delayed unless</td>
</tr>
<tr>
<td>Change Principle</td>
<td>Description</td>
<td>Details</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>7</td>
<td>Administrator leadership is essential to long-term change success.</td>
<td>When people at the bottom level of an organization begin to implement change such as a new technology, the long-term success of the innovation will never happen unless supportive leadership of the change is present.</td>
</tr>
<tr>
<td>8</td>
<td>Mandates can work.</td>
<td>A strategy often used in the adoption of an innovation like technology is to make the change a mandate. A mandate offers a clear expectation that the technology will be implemented. When a mandate is accompanied by continuing communication, ongoing training, on-site coaching, and time for implementation, it can work.</td>
</tr>
<tr>
<td>9</td>
<td>The school is the primary unit for change.</td>
<td>The key organizational unit for making change successful is the school. The school’s staff and leaders will make or break any change efforts, such as technology, regardless of whether the change is initiated from the inside or outside.</td>
</tr>
<tr>
<td>10</td>
<td>Facilitating change is a team effort.</td>
<td>Facilitating change is the responsibility of every team member in an organization if the team shares the responsibility of being a leader of the technological change.</td>
</tr>
<tr>
<td>11</td>
<td>Appropriate Interventions reduce resistance to change.</td>
<td>Resistance to change efforts such as technology integration can be difficult to handle, but with appropriate interventions to alleviate misunderstandings and help individuals on a personal level to reduce resistance.</td>
</tr>
<tr>
<td>12</td>
<td>The context of the school influences the process of change.</td>
<td>Typically employees of schools often reflect on its work with students and assess its influence on student results. This community of professional learners embodies individuals who value change and who seek change in order to increase their effectiveness of teaching. A learning-oriented staff can contribute profoundly to how a change such as technology integration unfolds and ultimately succeeds in a given school.</td>
</tr>
</tbody>
</table>

(Hall & Hord, 2006)
Fullan (1991, 2007) saw diffusion of education innovations as a three-phase process, including *initiation*, *implementation*, and *continuation*. Initiation consists of the process that leads up to and includes a decision to adopt or proceed with a change. Implementation involves the first experiences of attempting to put an idea or reform into practice. This stage usually spans the first two or three years of use. Continuation refers to whether the change gets built in as an ongoing part of the system or disappears by way of a decision to discard or through attrition.

In a study looking specifically at the diffusion of instructional technology, H. R. Marcinkiewicz (1993) looked at 170 elementary school teachers and found that teachers’ adoption of technology is developmental and progresses through stages. Marcinkiewicz (1993) defined three levels of change: a) nonuse is the absence of any use of computers at all for teaching, b) utilization involves how the teachers use technology to supplement classroom activities, and c) integration involves the teachers believing that the technology is a critical aspect of the teachers’ curriculum. Of the 170 teachers surveyed, only 8% were at the integration level. The rest of the respondents were split fairly evenly between nonuse (45%) and utilization (47%).

Hooper and Rieber (1995) built on this three-stage model used by Marcinkiewicz and added two additional stages, reorientation and evolution. Familiarization, utilization, and integration involve the traditional perspective of educational technology focusing on either the technology itself or a teacher’s instruction and are limited to the first three phases. *Reorientation* and *evolution* involve the contemporary perspective of educational technology focusing on a learner’s active construction of knowledge. The first phase of Hooper and Rieber (1995) is the *familiarization* phase, which is concerned with one’s initial exposure to and experience with technology. This stage can be compared to Marcinkiewicz’s (1993) level of nonuse or initial experience. The second phase is *utilization* and occurs when the teacher tries out the technology or innovation in the classroom, similar to utilization stage of Marcinkiewicz. In this phase, if problems occur, the technology is usually discarded quickly. The third phase represents the “break through” phase called *integration*. 
very similar to Marcinkiewicz. The teacher commits to the technology; it is no longer “expendable.”

The fourth phase is called reorientation, which requires that educators reconsider and reconceptualize the purpose and function of the classroom. The focus is on students’ learning, not the teacher’s instruction. The last phase is called evolution, which serves as a reminder that the educational system must continue to evolve and adapt to remain effective. The full potential of any educational technology can only be realized when educators progress through all five phases, otherwise, the technology will likely be misused or discarded (Hooper & Rieber, 1995).

Expanding on Hall and Hord (1987) and Rogers (1995, 2003), Sherry et al. (2000) discussed a cyclic process in which teachers move from learning the technology, adopting technology primarily for personal and task management, developing a clear connection between technology and the curriculum, and reaffirming or rejecting the technology. Finally, Sherry, Billig, Tavalin, and Gibson (2000) added a fifth stage that goes beyond other models, Teacher as Leader, where once teachers have affirmed their integration of technology into the curriculum, they expand their roles to teach technology skills to peers or to become involved in researching their own practice. Table 6 outlines effective strategies to allow for teachers to progress through the technology adoption model of Sherry et al. (2000).
Table 6.

**Effective Strategies for the Stages of Learning/Adoption**

<table>
<thead>
<tr>
<th>Developmental Stage</th>
<th>Effective Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stage 1</strong></td>
<td></td>
</tr>
<tr>
<td><em>Teacher as Learner</em> – In this information gathering stage, teachers learn the knowledge and skills necessary for performing instructional tasks using technology.</td>
<td>Time for training: demonstrations of promising practices; ongoing professional development by peers rather than one-shot workshops by outside experts; in-service sessions that stress the alignment of technology with curriculum and standards.</td>
</tr>
<tr>
<td><strong>Stage 2</strong></td>
<td></td>
</tr>
<tr>
<td><em>Teacher as Adopter</em> – In this stage, teacher’s progress through stages of personal and task management concern as they experiment with the technology, begin to try it out in their classrooms, and share their experiences with their peers.</td>
<td>Online resources, help desks and other forms of readily accessible technical support; mechanisms to deal with technical problems as they arise; in-building technical specialists; other technology-savvy teachers who can mentor new users and provide them with care and comfort as well as information; open lab workshops at school sites to solve specific technical problems.</td>
</tr>
<tr>
<td><strong>Stage 3</strong></td>
<td></td>
</tr>
<tr>
<td><em>Teacher as Co-Learner</em> – In this stage, teachers focus on developing a clear relationship between technology and the curriculum, rather than concentrating on task management aspects.</td>
<td>Workshops and online resources with strategies for enhancing instruction and integrating technology into the curriculum; collegial sharing of standards integration; exemplary products and assessment ideas; use of students as informal technical assistants.</td>
</tr>
<tr>
<td><strong>Stage 4</strong></td>
<td></td>
</tr>
<tr>
<td><em>Teacher as Reaffirmer or Rejecter</em> – In this stage, teachers develop a greater awareness of intermediate learning outcomes. They begin to create new ways to observe and assess impact on student products and performances, and to disseminate exemplary student work to a larger audience.</td>
<td>Administrative support; an incentive system that is valued by adopting teachers; awareness of intermediate learning outcomes such as increased time on task, lower absenteeism, greater student engagement, and increased metacognitive skills; evidence of impact on student products and performances; dissemination of exemplary student work.</td>
</tr>
<tr>
<td><strong>Stage 5</strong></td>
<td></td>
</tr>
<tr>
<td><em>Teacher as Leader</em> – In this stage, experienced teachers expand their roles to become active researchers who carefully observe their practice, collect data, share the improvements in practice with peers, and teach new members. Their skills become portable.</td>
<td>Incentives for co-teaching on-site workshops; release time and other semi-permanent role changes to allow peer coaching and outside consulting; support from an outside network of teacher-leaders; structured time for leading in-house discussions and workshops; transfer of skills if teacher goes to another school.</td>
</tr>
</tbody>
</table>

(Sherry, Billig, Tavalin, & Gibson, 2000)
In 1996, Sandholtz and Ringstaff, analyzing a ten-year longitudinal study, described five stages of changes in instructional use of technology and Apple researchers (Dwyer, Ringstaff, & Sandholtz, 1991) who were part of the Apple Classroom of Tomorrow (ACOT) project that spanned most of the 1980s and early 1990s described the same five stages of change. The first of these stages is entry, where teachers are simply learning about the technology and possibly beginning to use it as a resource. The second stage, adoption, is where teachers use computers to support their existing methods of teaching simple drill and practice. The third stage, adaptation, is when teachers are integrating more technology and they may be noticing an increase in efficiency. The fourth stage, appropriation, involves the switching of roles between the student and teacher from a teacher-led classroom to a more student-centered classroom. The final stage, invention, is where teachers continue to integrate technology using wide instructional patterns that are both teacher and student centered.

The CEO Forum (1999), in its report School Technology and Readiness Report: Year 2 put forward a model of teacher technology adoption. The stages underscore the idea that understanding and using technology well takes time. The stages suggest the need for tailored activities for professional development. They are as follows: a) Entry, students learning to use technology, but teachers are not themselves the technology users. Technology may be in the classroom at this stage, but the teachers do not participate in technology utilization; b) Adoption, teachers use technology to support traditional instruction normally in a limited way. The teacher uses technology to perform basic tasks that might have been done previously by non-technology methods; c) Adaptation, technology is used to enrich curriculum such as using a web resource to supplement a lesson. Teachers at this stage tend to direct student inquiry rather than allowing student-directed learning experiences; d) Appropriation - technology is integrated and used for unique capabilities. Teachers view technology as a relevant tool for teaching and learning, and they tailor learning experiences that meet objectives and desired outcomes. At this stage technology begins to reveal its potential to
produce improvements in learning; and e) *Invention* – teachers are discovering new uses for technology by redefining classroom environments and creating learning experiences that truly leverage the power of technology to provide students with higher-order thinking skills. Tailoring professional development opportunities to teacher and student skills and levels can help schools ensure that technology is not merely considered inevitable, but is recognized as a valuable tool for creativity, collaboration, and innovation in teaching and learning.

Moersch (2002) attempted to combine the CBAM stages of use with an explanation of teachers’ instructional practices based on Bloom’s (1956) Taxonomy. Moersch like the other theorists saw change as a process and has defined Levels of Technology Implementation. Moersch’s model is similar to Sandholtz and Ringstaff (1996) in that teachers use the technology to engage students in learning activities that are more and more constructivist in nature. The levels of technology implementation have a dual focus on technology use and types of thinking skills taught. The first level is *nonuse* where the technology is normally not used in the classroom. The next level is *awareness* where technology is not integrated into student learning but may be used in a computer lab. The third level is *exploration* where technology is used as a supplement to support lower order thinking skills. The fourth level is *infusion* where technology is used for higher-order thinking skills, which is similar to the appropriation stage of the CEO Forum. The fifth level is *expansion* when technology is used outside the classroom to connect problem-based learning with real-life experiences. The last level is *refinement* where there is no longer a separation between instruction and technology, and the curriculum is entirely based on the needs of the learner’s interests with unlimited access to technology.

All of the above models for technology adoption share a sense that change is a process that can take a long period of time. The models also share the idea that as teachers learn more about the innovations and become comfortable using the technological innovations patterns often develop that change traditional ways of teaching to include the new technology. According to Straub (2009), the
decision to or not to adopt an innovation can be a one-time event, the route that leads to one’s decision does not take place in a vacuum. Beliefs and attitudes are formed over time, which in turn may influence decisions.

Factors Influencing the Adoption of an Innovation

Why do some innovations become widely adopted while some do not? Why does one individual choose to adopt a technology while another resists? Most theories share three categories/characteristics that influence the adoption and/or diffusion of an innovation. These categories are foundation drivers of change. These are a) individual characteristics that predispose a person to seek out or shun change (Fullan, 2005, 2007; Marcinkiewicz, 1993; Rogers, 1995, 2003) engaging moral purpose (Fullan 2005, 2007) and knowledge, skills, and attitudes of individuals (Guskey, 1986); b) characteristics that are specific to the innovation (Fullan, 1991, 2007; Rogers, 1995, 2003) understanding the change process (Fullan, 2005; Ertmer, 1999; Hall & Hord, 1984; Horsley & Loucks-Horsley, 1998; Rogers, 1995; Marzano, Waters, & McNulty 2005); and c) characteristics of the setting or culture which include building capacity, resources, professional community/communities of practice, program coherence, and shared leadership (Cuban, 1993; DuFour, 2004; Fullan, 1991, 1997, 2001, 2004, 2005; Hagner, 2000; Lambert, 1998; Newmann et al., 2000).

Individual Characteristics

The stages of technology integration/adoption vary among the different change models, but most theorists agree that not all people move through the different stages at the same pace. In short, some people seem to be more innovative than others (Marcinkiewicz, 1993; Rogers, 1995, 2003).

Rogers (1995, 2003) divided individuals into five groups based upon their degree of innovativeness. Figure 2 shows the normal frequency distribution by Rogers (2005), divided into five adopter categories: (a) innovators, (b) early adopters, (c) early majority, (d) later majority, and (e) laggards.
Innovators, which make up 2.5%, can be described as venturesome in that they can almost be obsessive in using the innovation. The innovator plays an important role in the diffusion process by launching the new idea in the system by importing the innovation from an outside source. The innovator plays a gate-keeping role in the flow of new ideas into a system.

The early adopter category makes up 13.5% of the normal distribution. The early adopters are more a part of the existing social system than innovators. The early adopter category has the highest degree of opinion leadership. Potential adopters look to early adopters for advice and information about the innovation. This category of adopters is normally sought out by change agents to help in the process of innovation adoption within the system because they can be considered role models for peers. Early adopters essentially “put their stamp of approval” on an idea.

Early majority adopters make up 34% of the distribution. This group of adopters normally adopts new ideas just before the average member of a system. The early majority interacts frequently with their peers but is seldom considered leaders. The early majority is one of the most numerous adopter categories, making up one third of all members of a system. This group may deliberate for some time before completely adopting a new idea. They follow with deliberate willingness to adopting innovations but seldom lead.
The late majority makes up 34% of the distribution just like the early adopters. The late majority adopts new ideas just after the average member. Adoption by this group could be contributed to peer pressure or economic reasons. Innovations are approached with a skeptical and cautious air, which makes them adopt the innovation only after most of the other members of the system have already done so. Peer pressure is often needed to motivate this group, and most of the uncertainty about the new ideas must be removed before they feel it is safe to adopt.

The last group is the laggards, which makes up 16% of the distribution. Laggards are the last in a social group to adopt an innovation, and they possess no leadership. Many of the laggards are considered isolates in the social networks, and their point of reference is focused on the past traditional methods. Laggards tend to be suspicious of innovations and of change agents. The innovation-decision process is often lengthy, and they must be certain that a new idea will not fail before they can adopt (Rogers, 2003).

**Engaging Moral Purpose**

The definition that Fullan (2004) has given for moral purpose is “The human desirability of a goal; in education moral purpose often involves raising the bar and closing the gap of student learning in the society as a whole” (p. 15). The first driver of change concerns knowledge about the why of change, namely moral purpose. In educational change, the moral purpose is about improving society through improving educational systems and thus the learning of all citizens.

If the process of change can improve the overall achievement of students it will directly improve the future economic productivity of a country. Moral purpose is not just a goal but also a process of engaging educators, community leaders and society as a whole in the moral purpose of reform. According to Fullan (2004, p. 3), “…if moral purpose is front and center, the remaining drivers become additional forces for enacting moral purpose.”
**Knowledge, Skills, and Attitudes of Individuals**

Staff development is seen as a systematic attempt to bring about change—change in the classroom practices of teachers, change in their beliefs and attitudes, and change in the learning outcomes of students. The failure of many staff development programs can be attributed to two critical factors: what motivates teachers to engage in staff development, and the process by which change in teachers typically takes place. Staff development needs to relate directly to ongoing classroom responsibilities that can impact student learning. The order of the desired outcomes from professional development sometimes is not considered and this may cause failure in the acceptance of change. Guskey (1986) suggested a focus on a different concentration of the order associated with the staff development. He recommended staff development focus on change in teachers’ classroom practices first, then change in student learning outcomes, and then change in teachers’ beliefs and attitudes. Implications for staff development reveal three guiding principles: a) recognize that change is a gradual and difficult process for teachers, b) ensure that teachers receive regular feedback on student learning progress, and c) provide continued support and follow-up after the initial training (Guskey, 1986).

**Characteristics of the Innovation**

The Stages of Concern of the CBAM model takes into account the individual’s feelings and concerns about an innovation (Hord et al., 1987). Individuals can only integrate the innovation in their classroom if their concerns are addressed (Hall & Hord, 1987, 2001; Hord et al., 1987). In order for an innovation to be successfully implemented, individuals must internalize the understanding and acceptance of the innovation. Innovation is often a process of clarification of meaning and moral purpose (Fullan, 1991, 2007). The Stages of Concern maps the process of stages that participants may go through that can influence the implementation of innovations while identifying concerns, interpreting them, and acting on them to make the process of change easier for
participants (Hord et al., 1987). Table 7 outlines the stages of concern about technology use, and identifies stages to guide change.

Table 7.

*Stages of Concern about Technology Use*

<table>
<thead>
<tr>
<th>Stages</th>
<th>Description</th>
<th>Stages to Guide Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness</td>
<td>• May or may not know about technology</td>
<td>• Involve teachers in discussions and decisions</td>
</tr>
<tr>
<td></td>
<td>• May or may not be ready to use technology</td>
<td>• Share enough information to stir interest, but not to overwhelm</td>
</tr>
<tr>
<td>Informational</td>
<td>• Wants to learn more about the technology</td>
<td>• Share information through all forms of media</td>
</tr>
<tr>
<td></td>
<td>• Curious how technology can be used with students</td>
<td>• Find those that are using the technology on and off-site and have them share what they are doing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Help teachers see how technology relates to their teaching practices</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Be enthusiastic about all who are using technology</td>
</tr>
<tr>
<td>Personal</td>
<td>• Has concerns about proficiency level</td>
<td>• Know these concerns are common and legitimate existence of concerns</td>
</tr>
<tr>
<td></td>
<td>• Does not want to look foolish at a workshop</td>
<td>• Connect teachers with similar concerns and those who will be supportive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Share how technology can be used in small attainable steps</td>
</tr>
<tr>
<td>Management</td>
<td>• Wants practical suggestions on how to use technology for specific purposes</td>
<td>• Explain components of technology and share “how-tos”</td>
</tr>
<tr>
<td></td>
<td>• Needs help with specific problems</td>
<td>• Demonstrate practical solutions to logistical problems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Help teachers create a timeline or plan on how to use technology for immediate concerns</td>
</tr>
<tr>
<td>Consequence</td>
<td>• Uses technology but not sure how to use with students or what activities are out there that use technology</td>
<td>• Provide opportunities to attend conferences or visit other teachers using technology with students</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Share lessons involving technology and post student work</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Give these people positive feedback and access to resources</td>
</tr>
</tbody>
</table>
Collaborative

- Would like to share lessons with other teachers
- Offers technical support to others
- Provide opportunities to develop skills
- Provide common planning time for these teachers
- Look for opportunities for these teachers to team on projects
- Use these teachers as mentors or coaches
- Provide opportunities to develop skills
- Provide common planning time for these teachers
- Look for opportunities for these teachers to team on projects
- Use these teachers as mentors or coaches

Refocusing

- Looks for ways to improve program
- Serves on technology committee
- Thinks “outside the box”
- Encourage these teachers to research and test new ideas and technologies
- Provide access to all resources so they can refine their ideas and put them into practice
- Allow these teachers to take risks

(Adapted from Hord, Rutherford, Huling-Austin, & Hall, 1987)

Understanding the Change Process

The understanding of the change process involves participants engendering ownership of the changes necessary to adopt an innovation (Ertmer, 1999; Fullan, 2005; Hall & Hord, 1987; Horsley & Loucks-Horsley, 1998; Rogers, 1995; Marzano, Waters, & McNulty (2005). Fullan (2004) believed that for change to work you need the energy, ideas, commitment and “ownership” of all those involved in implementing the improvements. The understanding of the change process may take more time than most members of a group are willing to expend on the project. It is important to not rush through this stage of the process, because backing from other people involved in the project may diminish if understanding is not complete.

According to Fullan (2004), there are six elements under the category of understanding the change process: strategizing vs. strategy, pressure and support, know about the implementation dip, understand the fear of change, appreciate the difference between technical and adaptive challenges, and be persistent and resilient. The first element of strategizing vs. strategy is about not creating a plan at the beginning that cannot be changed as the process progresses. The change process is about shaping and reshaping ideas and actions. The second element of understanding is about the realization that all large-scale reform requires a combination of integration of “pressure and support.”
Pressure means ambitious targets and support involves developing new competencies. The third element of understanding is that all successful change proceeds through an “implementation dip.” Changes do not always go smoothly in the early stages of adoption and the expectation of dips can reduce the period of awkwardness. The fourth element of understanding change is about the always-prevalent fear of change. Gains cannot be realized until implementation is mastered. The fear of technology has been a barrier to integration in many research studies (Bitner & Bitner, 2002; Crowther, Kaagan, Ferguson, & Hann, 2002; Harrington, McElroy & Morrow, 1990; Schein, 1995).

The fifth element of understanding change is understanding the distinction between “technical problems” and “adaptive challenges” (Heifetz & Linsky, 2003). Technical problems are ones for which current knowledge is sufficient to address the problem. Adaptive challenges go beyond what one normally knows and are more complex. The final aspect of understanding change as a process involves the need for persistence to overcome the inevitable challenges. Fullan (2004) stated, “because change processes are complex, difficult and frustrating it requires pushing ahead without being rigid; regrouping despite setbacks; and not being discouraged when progress is slow” (p. 8).

**Characteristics of the Setting or Culture**

The characteristics and concerns of the individuals involved in the diffusion process are important. Also of importance are the characteristics of the setting or culture, which include building capacity, resources, professional community/communities of practice, program coherence, and shared leadership.

**Building Capacity**

Building capacity involves collective and ongoing policies, strategies, resources, and other actions to increase organizational power to adopt the innovation (Newmann, King, & Youngs as cited in Fullan, 2005). Capacity building involves the development of new knowledge, skills, and competencies; new resources; and new shared identity and motivation to work together for greater change (Fullan, 2004). As mentioned by Hall and Hord (2006) in change principle ten, facilitating
change is the responsibility of every team member in an organization if the team shares the responsibility of being a leader of the technological change. Normally, school organizations consist of professional learners who value change and who seek change in order to increase their effectiveness of teaching. Capacity is often the missing element in the need for change. Capacity has two characteristics:

1. It is a ‘collective’ phenomenon. Whole schools, whole districts and whole systems must increase their capacity as groups. This is difficult because it involves working together in new ways. The change principles of Hall and Hord (2006), reiterates the importance of having the support of individuals, teams, and administration when implementing changes like technology integration because it is not a simple one-step process, but contains stages that cannot be accomplished in a short period of time.

2. Capacity must be evident in practice and be ongoing. This is why front-end training is insufficient—it does not transfer into improvements in the daily cultures of how people need to work in new ways. (Fullan, 2004, p. 4)

Newmann et al. (2000) identified five components of change capacity within the school, which include the development of new knowledge and skills, establishing professional learning communities, program coherence, access to new resources, and principal/school leadership. Development of new knowledge and skills is important in the acceptance of new technologies. For many educators, technology brings about brand new concepts and skills that they may not understand clearly. Sustained staff development is key in developing new knowledge and skills regarding the integration of technology. Newmann et al. (2000) argued that professional development should address all aspects of capacity rather than only the competence of individual teachers. Professional learning communities ensure that teachers no longer work in isolation, but share responsibilities, share leadership, share the same vision, and desire to help students learn. New innovations such as technology can be overwhelming to individuals alone, but with a learning community members share a vision for learning and change. Program coherence involves the extent to which technology integration is coordinated with clear learning goals over a sustained amount of time. Access to new resources with technology involves high-quality professional development and documentation.
regarding the hardware along with curricular materials adapted to the technology. Principal/school leadership is necessary in implementing any new innovation including technology. If a few teachers in a school believe in the importance of integrating technology, without leadership support for the technology it will falter and eventually lead to the demise of the innovation. Capacity building includes the building of an infrastructure of support that is aligned with the philosophy and mission of the school and includes the process for selecting personnel, resources, staff training, work structures, policies and available outside networks (Lambert, 1998). A synthesis of the ingredients in a school’s capacity includes: the knowledge, skills, and dispositions of individual teachers; the strength of the school’s professional community; the extent to which its programs are coherent, focused and sustained over time; the nature of the principal’s leadership; the quality of its technical resources; the organizational autonomy to act according to the demands of the local context; and the degree to which the human, technical, and social resources of an organization are organized into a collective enterprise (Newmann, King, & Rigdon, 1997; Newmann et al., 2000). Collective power of an entire faculty with the same vision provides a better chance that the process of change will benefit the entire school.

**Resources**

As referenced above by several researchers, the process of change is a slow process without the needed infrastructure, tools, people, money, and time necessary to adopt the innovation. The resources do not need to be overlooked in the change process and should be considered while building capacity.

**Professional Community/Communities of Practice**

Effective schools develop the collective capacity of the full staff to improve achievement. The professional community at the school allows teachers to develop skills, provides quality ongoing interaction among the staff, achieves a coherent focus, allows for mobilizing resources, and develops school leadership (Newmann et al., 2000). DuFour (2004) described professional learning
communities as contributing to high performance while ensuring that all students learn, fostering a culture of collaboration, and focusing on results.

Knowledge sharing and collective identity are powerful forces for positive change, and they form a core component of our change knowledge (Fullan, 2004). The core mission of formal education is not simply to ensure that students are taught but to ensure that they learn. Collaboration in a professional learning community often reveals a collective purpose of learning and shared vision among the group. People stimulate, inspire, and motivate each other to contribute and implement best ideas, and best ideas mean greater overall coherence (Fullan, 2001). When the community focuses on the results of student achievement as a collective group, the pressure often placed on individuals is lessened (DuFour, 2004).

Program Coherence

Youngs and King (2002) defined program coherence as “the extent to which the school’s programs for student and staff learning are coordinated, focused on clear learning goals, and sustained over a period of time” (p. 646). Program coherence involves alignment, connecting the dots, and being clear about how the big picture fits together (Fullan, 2005).

Shared Leadership

The underlying assumption of shared leadership is that everyone has the potential and right to work as a leader and that leadership is the professional work of everyone in the school (Lambert, 1998; Lambert, 2002; Lambert, 2003). The key notion in this definition is that

Leadership is about learning together, and constructing meaning and knowledge collectively and collaboratively. It involves opportunities to surface and mediate perceptions, values, beliefs, information, and assumptions through continuing conversations; to inquire about and generate ideas together; to seek to reflect upon and make sense of work in the light of shared beliefs and new information; and to create actions that grow out of these new understandings. (Lambert, 1998, pp. 5-6)
Shared leadership suggests shared responsibility for a shared purpose of community. Shared leadership calls for broad-based participation, which means involving many people—administrators, parents, students, community members, system personnel—in the work of leadership. Shared leadership also calls for participants’ comprehensive understanding of and demonstrated proficiency in the dispositions, knowledge, and skills of leadership (Lambert, 1998). Table 8 shows the leadership capacity matrix designed by Linda Lambert.

Table 8.

*Leadership Capacity Matrix*

<table>
<thead>
<tr>
<th>Leadership Capacity Matrix</th>
<th>Low skillfulness</th>
<th>High skillfulness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Participation</td>
<td>Autocratic</td>
<td>Laissez-faire</td>
</tr>
<tr>
<td></td>
<td>administration</td>
<td>administration</td>
</tr>
<tr>
<td>Limited (primarily one-way)</td>
<td>Limited</td>
<td>Fragmentation</td>
</tr>
<tr>
<td>flow of information</td>
<td>flow of</td>
<td>and lack of</td>
</tr>
<tr>
<td>Codependent, paternal</td>
<td>information</td>
<td>coherence of</td>
</tr>
<tr>
<td>relationships</td>
<td></td>
<td>information</td>
</tr>
<tr>
<td>Rigidly defined roles</td>
<td>Norms of</td>
<td>and programs</td>
</tr>
<tr>
<td>Norms of compliance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of innovation in</td>
<td>Undefined roles</td>
<td>Both excellent</td>
</tr>
<tr>
<td>teaching and learning</td>
<td>and responsibilities</td>
<td>and poor</td>
</tr>
<tr>
<td>Student achievement poor</td>
<td>“Spotty” innovation</td>
<td>classrooms</td>
</tr>
<tr>
<td>or showing short-term</td>
<td></td>
<td></td>
</tr>
<tr>
<td>improvement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Participation</td>
<td>Trained leadership</td>
<td>Broad-based, skillful</td>
</tr>
<tr>
<td></td>
<td>or site-based</td>
<td>participation in</td>
</tr>
<tr>
<td>management team</td>
<td>management team</td>
<td>the work of</td>
</tr>
<tr>
<td>Limited uses of school</td>
<td></td>
<td>leadership</td>
</tr>
<tr>
<td>wide data, information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>flow</td>
<td></td>
<td>Inquiry-based use</td>
</tr>
<tr>
<td>Within designated leadership</td>
<td></td>
<td>of information to</td>
</tr>
<tr>
<td>groups</td>
<td></td>
<td>inform decisions</td>
</tr>
<tr>
<td>Polarized staff,</td>
<td></td>
<td>and practice</td>
</tr>
<tr>
<td>pockets of strong resistance</td>
<td></td>
<td>Roles and</td>
</tr>
<tr>
<td>Designated leaders</td>
<td></td>
<td>responsibilities</td>
</tr>
<tr>
<td>acting efficiently; others</td>
<td></td>
<td>that reflect broad</td>
</tr>
<tr>
<td>serving in traditional</td>
<td></td>
<td>involvement and</td>
</tr>
<tr>
<td>roles</td>
<td></td>
<td>collaboration</td>
</tr>
<tr>
<td>Pockets of strong</td>
<td></td>
<td>Reflective practice/innovation as the norm</td>
</tr>
<tr>
<td>innovation and excellent</td>
<td></td>
<td>High student</td>
</tr>
<tr>
<td>classrooms</td>
<td></td>
<td>achievement</td>
</tr>
<tr>
<td>Student achievement static</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or showing slight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>improvement</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Lambert, 1998)

**Summary**
Models of change indicate that when an innovation is introduced into education, it may be rejected, modified, or adapted. The reaction of educators to an innovation is a process involving many stages and includes the characteristics of the people involved, the setting, and the innovation itself. The literature review surrounding this topic revolves around technology and the diffusion/adoptions models associated with general change, educational change, and technology change.
METHODS

Introduction

The purpose of this study was to explore the beliefs and perceptions of teachers in a project funded by an EETT grant for technology integration, concentrating on factors that reveal how the implementation of the 21st century hardware and staff development might have changed the atmosphere of their classrooms and teaching practices. The project was modeled after the IMPACT model from North Carolina (North Carolina Department of Instruction, 2000a). This case study sought to explain teachers’ acceptance of technology integration as an innovation, identify factors that teachers felt shaped them into becoming technology integrators, and note identifiable changes in their own teaching practices. The theory behind this study revolved around diffusion/adoption change theories.

A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context (Yin, 2009). The qualitative case study approach was used because the research interest is anchored in real-life situations that will result in a rich and holistic account of the phenomenon (Merriam, 1998). A case study design was employed to gain an in-depth understanding of the situation and meaning for those involved. This study focused on the process rather than outcomes, in context rather than a specific variable, and in discovery rather than confirmation (Merriam, 1998). The study revolved around three school systems involved in one collaborative project, which led the researcher to use a multi-site case study approach. Qualitative research is well-suited to this study because the researcher viewed the phenomena holistically in its natural setting and this contributed to understanding the context within which the participants act and the influences that this context has on their actions (Maxwell, 2005).

Setting

43
The setting for this research study took place in three counties in the southern part of Alabama. These three counties collaborated together to write an EETT competitive technology grant application in 2007. The grant requested money to outfit classrooms in each county with 21st century technology. Table 9 shows a summary of the characteristics of the school systems involved in the grant. The demographics of each school system are shown with the number of classrooms targeted in the EETT grant along with the grade level or subject of the targeted classrooms.

Table 9.

Summary of Characteristics of School Systems

<table>
<thead>
<tr>
<th>System</th>
<th>Number of Schools</th>
<th>Number of Classrooms Targeted</th>
<th>Grade Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>System 1</td>
<td>12</td>
<td>16</td>
<td>7-12 Science</td>
</tr>
<tr>
<td>System 2</td>
<td>15</td>
<td>8</td>
<td>6-8</td>
</tr>
<tr>
<td>System 3</td>
<td>4</td>
<td>16</td>
<td>6-8</td>
</tr>
</tbody>
</table>

Table 10 shows the list of 21st century equipment purchased for each targeted classroom.

Table 10.

Summary of Equipment Purchased

<table>
<thead>
<tr>
<th>County</th>
<th>Equipment Purchased Per Classroom</th>
</tr>
</thead>
<tbody>
<tr>
<td>System 1</td>
<td>Tablet PC, document camera, mounted projector, DVD/VCR, sound enhancement system, student response system, wireless slate, screen</td>
</tr>
<tr>
<td>System 2</td>
<td>Document camera, mounted projector, sound enhancement system, student response system, wireless slate, screen</td>
</tr>
<tr>
<td>System 3</td>
<td>Document camera, mounted projector, sound enhancement system, DVD/VCR, student response system, wireless slate, screen</td>
</tr>
</tbody>
</table>

The researcher sought in-depth information from the three counties involved in the EETT grant. The funds from the EETT grant were used to (a) prepare one or more teachers in schools as
technology leaders who assist other teachers, and providing bonus payments to the technology leaders; (b) acquire new technology to support education reforms and to improve student achievement by creating 21st Century classrooms; (c) use technology to collect, to manage, and to analyze data to inform and enhance teaching and school improvement efforts; and (d) adapt or expand applications of technology to enable teachers to increase student academic achievement, including technology literacy, through teaching practices that are based on the review of relevant research and through use of innovative distance learning strategies.

Participants

This researcher interviewed two teachers from each county and the three technology coordinators from each county on their perceptions of how the technology has changed the classroom and teaching practices. The technology coordinators were contacted by the researcher after prior approval was provided by each system’s superintendent and then asked to select two teachers from their system. The technology coordinator of each system selected teachers based on as many as possible of the following criteria:

1. 21st century project teacher;
2. One elementary teacher and one middle/high school teacher;
3. Teacher who uses 21st century project technology on a regular basis;
4. Teacher who participated in summer training;
5. Teacher who regularly participated in subsequent training throughout school year;
6. Teacher who participated in professional learning community; and
7. Teacher who has developed technology related lessons to use with the new equipment.

Table 11 shows an outline of each participant along with their educational experience and position/grade level within each system.
Table 11.

Combined Participants’ Background Information

<table>
<thead>
<tr>
<th>County</th>
<th>Participants</th>
<th>Educational Experience</th>
<th>Position/grade level</th>
</tr>
</thead>
<tbody>
<tr>
<td>System 1</td>
<td>Tech Coordinator 1 (TC-1)</td>
<td>25</td>
<td>Technology Coordinator</td>
</tr>
<tr>
<td>System 1</td>
<td>Teacher A-1 (T A-1)</td>
<td>23</td>
<td>Science/10th grade</td>
</tr>
<tr>
<td>System 1</td>
<td>Teacher B-1 (T B-1)</td>
<td>12</td>
<td>Science/8th grade</td>
</tr>
<tr>
<td>System 2</td>
<td>Tech Coordinator 2 (TC-2)</td>
<td>8</td>
<td>Technology Coordinator</td>
</tr>
<tr>
<td>System 2</td>
<td>Teacher A-2 (T A-2)</td>
<td>12</td>
<td>Science/8th grade</td>
</tr>
<tr>
<td>System 2</td>
<td>Teacher B-2 (T B-2)</td>
<td>6</td>
<td>Core Subjects/6th grade</td>
</tr>
<tr>
<td>System 3</td>
<td>Tech Coordinator 3 (TC 3)</td>
<td>15</td>
<td>Technology Coordinator</td>
</tr>
<tr>
<td>System 3</td>
<td>Teacher A-3 (T A-3)</td>
<td>15</td>
<td>Math/8th grade/11th grade/12th grade</td>
</tr>
<tr>
<td>System 3</td>
<td>Teacher B-3 (T B-3)</td>
<td>10</td>
<td>Math/6th grade</td>
</tr>
</tbody>
</table>

Note: TC=Technology Coordinator, T=Teacher

One system focused its grant on science classrooms for grades 7-12, and the other two systems focused their grants on middle school classrooms for grades 6-8. The technology coordinators developed this project as a collaborative effort between the technology coordinators and each system. The technology coordinators wanted to develop a cadre of school-based teaching and learning school technology coordinators that would act as mentors to teachers at their respective schools. The objective was to integrate technology into teaching and learning to improve student achievement while being led by specific guidelines outlined in the North Carolina IMPACT model and authentic evaluations strategies developed in collaboration with the State Department of Education. The individual counties developed a professional learning community between the technology coordinators and teachers within each system.

Instrumentation
The researcher was the instrument used in this qualitative case study. An interview protocol was developed before conducting the interviews, and the questions were used as guided conversation. The information addressed before each interview was specified in advance, but the researcher defined the sequence and wording of the questions during the interview. Minimization of researcher bias was done through careful, detailed, and thorough documentation of all interviews. Each interview was recorded with a digital recorder and transcribed. Interview transcripts, archival data and field notes were analyzed and compared through triangulation. Data were peer-reviewed by colleagues to enhance credibility and dependability of the study. See the interview protocol in Appendix A.

Data Collection

The data collection methodology for this case study addressed the research questions and relied primarily on in-depth interviews with technology coordinators and teachers who had received the 21st century technologies in their classrooms. At each school system a 60-minute, semi-structured, in-depth interview was conducted with the technology coordinator; a 60-minute, semi-structured, in-depth interview was conducted with two individual teachers at their schools. Informed consent forms were presented to the participants prior to data collection and each participant was given the opportunity to review the informed consent document before signing it. The researcher took detailed notes and audio taped the in-depth interviews. The recorded interviews were transcribed verbatim. According to Merriam (1998), verbatim transcriptions of recorded interviews provide the best database for analysis. In-depth interviewing is the dominant strategy for data collection in qualitative research and can be described as a purposeful, guided conversation between two people with the goal of gathering descriptive data in the subject’s own words (Marshall & Rossman, 1999; Yin, 2003). The expectation for interviewing in qualitative research is that the conversation with the respondent will provide a great deal of information and in keeping with the assumptions of qualitative research the “participants’ perspective on the phenomenon of interest
should unfold as the participant views it, not as the researcher views it (Marshall & Rossman, 1999). The researcher collected field notes regarding descriptions of physical settings and of the interviewees’ behavior and personal insights. Archival data such as: technology plans, project based plans, staff development agendas, evaluation instruments, project videos, and grant application were collected. The researcher’s goal in this study was to collect data targeted directly on the case study topic that would provide rich description of perceptions, feelings, attitudes, and ideas of the participants.

Validity and Reliability

Validity and reliability in qualitative research involves conducting the investigation in an ethical manner that implies trustworthiness in the results of the study. This research used strategies that speak to the trustworthiness, authenticity, and credibility of the research (Creswell, 2003). This qualitative research study established construct validity and reliability by using multiple sources of evidence (Yin, 2004).

Triangulation

A strength of the multi-site case study is the opportunity to use a wide variety of sources of evidence. According to Yin (2009) “…any finding or conclusion in a case study is likely to be more convincing and accurate if it is based on several different sources of information” (p. 98). This multi-site case study employed the process of triangulation by providing multiple data sources and multiple data collection procedures in order to gather information with an aim to corroborate the same phenomena and to examine evidence from the different data sources using it to build a “coherent justification for themes” that is presented (Creswell, 2003, p. 196). According to Maxwell (2005), the triangulation process of collecting information from a diverse range of individuals using a variety of methods reduces the risk that the conclusions will reflect systematic biases and allows a broader understanding of the study’s issues.
Multiple data sources were obtained from three public school systems and from each school data were collected from the technology coordinators and the project teachers. Data were collected by conducting in-depth interviews with the technology coordinators and teachers of each system. Additional data collected included the EETT grant application from each system, project video, training agendas, brochures, teacher consent forms, researcher field notes, and related articles published by participants.

The comparison of data gathered supported the triangulation process and enhanced internal validity. Construct validity and triangulation were broadened by the use of three public school systems as multiple sources of evidence, which measure the same phenomenon. In addition, any threats to the valid description of “rich data” that are detailed and varied enough that they provide a full and revealing picture of what is going on were avoided by audio taping, recording, and verbatim transcription of the interviews (Maxwell, 2005). Efforts to control any threats to theoretical validity were made by collecting and drawing attention to any discrepant data or alternative explanations.

Ethical Considerations

Educational qualitative research makes use of a human participant from whom or about whom the data are collected and therefore ethical and legal considerations must be prevalent during the study. Informed consent was obtained from each of the participants by providing a detailed consent form (see Appendix D) for participants to read and sign before the in-depth interviews were conducted. There is a responsibility to respect the “rights, needs, values and desires of the informants” (Creswell, 2003, p. 201). Written permission to conduct the study and gain access to each school system was obtained from the superintendent of each system. The consent forms outlined the study to participants as being voluntarily, a clear articulation of the purpose of the study in order to assure that individuals understood the nature of the study and its impact, a description of the procedures of the study so that the participants could anticipate their involvement, and a reference to the participants’ privacy (Creswell, 2003).
The anonymity of the system sites and the confidentiality of the participants were maintained through the use of coded pseudonyms. The identification of individual participants was not made public and data were referenced in a manner that was not identifiable to their sources.

Data Analysis

The data analysis consisted of examining, categorizing, or otherwise recombining the qualitative evidence in order to address the purpose of the study (Yin, 2009). Data analysis does not always proceed in a linear manner and it is an ongoing search for general statements about relationships between categories of data (Marshall & Rossman, 1999). The interviews were recorded and transcribed for analysis. In qualitative research, the goal of coding is not to count things, but to “fracture” (Strauss, 1987, p. 29) the data and rearrange them into categories that facilitate comparisons between things in the same category and that aid in the development of theoretical concepts. The transcripts were analyzed through the coding process including open coding, axial coding, and selective coding. Themes emerged from the coding that was compared to field notes and archival data to determine patterns. The codes that emerged from the data were compared to the overall theoretical perspective.

Analyses of the data took place within Rogers’ model of diffusion of innovations; Hall and Hords’ Concerns Based Adoption Model; and Sherry, Billig, Tavalin and Gibson’s Technology Adoption Model. Most theories share three categories/characteristics that can influence the adoption and/or diffusion of an innovation. These categories included individual characteristics, characteristics of the innovation, and characteristics of the setting. The coding of the interviews compared with the archival data from the project revealed themes that fell into the three categories that can influence adoption/diffusion of innovations.

Researcher Positionality

Qualitative research views the researcher as the primary instrument for gathering and analyzing data and can respond to the situation by maximizing opportunities, for collecting and
producing meaningful information (Merriam, 1998). As the researcher, I interviewed participants of the study with a lens of openness, honesty, objectivity, and understanding.

I have over fifteen years experience in the educational field surrounding the use of computers. I taught eighth grade students for thirteen years about using computers in their everyday life. I have had three years of experience as a technology integration specialist for a middle-sized school system of around 8,000 students. I believe that computers can be a valuable resource for all educators to use to help students achieve greater success. I am expressing my own ideas regarding how I feel technology can improve education, but I listened to the participants being interviewed and kept an open mind about the perceptions of teachers regarding the use of technology. Bias in my study is possible based on my personal beliefs regarding technology, but field notes, interview transcripts, and previous research guided my analysis of the data collected to overshadow my own personal beliefs to reach my goal for undertaking this study so as to contribute to the improvement of education, particularly the ways that educational technology can contribute to teaching and learning. I feel that when working with technology and teachers’ use of new innovations, it is important to understand where learners are in relationship to their skill level, professional and personal use of technology, and comfort level of working with technology. I have a personal vision of continually searching for knowledge. I have been privileged to be able to work with K-12 students, teachers, and faculty in devising ways to integrate technology and to model ways in which this tool is used to best facilitate learning in all of education.

This chapter explained and justified the methods within the framework of the qualitative research design that this researcher used to allow readers to see how the technology coordinators and teachers involved in the 21st century integration project perceive innovation and change. The procedures for the selection, description and recruitment of the participants and the school systems were presented. The overview of the methodology established the data collection methods that were used in this multi-site case study conducted at three public school systems as well as the constant
comparative method with which the collected data were analyzed in order to address the research questions of this study. The data analyses are presented in a rich detailed narrative in Chapter IV.
CHAPTER IV:

RESULTS

According to Merriam (2003), a case study is an intensive, holistic description and analysis of a single, bounded unit. Conveying an understanding of the case is the paramount consideration in analyzing the data. The intention of this study was to better understand the participants’ perceptions of educational change in relation to 21st century technology implementation. The study explored the attitudes, practices, and perceptions of the participants involved in the collaborative effort between the three school systems. This chapter presents a comprehensive description of each system’s participation in the 21st century project. It is based on the participants’ perceptions and conversations that took place in response to the research questions:

1) Does an enhancing education through technology grant lead to innovation and change;

2) What are the teacher perceptions of innovation and change regarding technology integration;

3) How has the technology supplied with the grant changed the classroom atmosphere; and

4) How has the staff development provided with the project encouraged teachers to collaborate and become part of a professional community?

The themes that surfaced from the responses were presented in each school’s narrative under the titles of individual characteristics, innovation characteristics, and setting characteristics. The data collection took place at three school systems that were selected based on the criteria outlined in Chapter III. All three systems were involved in the 21st century project developed as a collaborative effort between the three systems. The project was designed to develop a cadre of school-based teaching and learning school technology coordinators to act as technology mentors to teachers at their schools to integrate technology into teaching and learning to improve student achievement.
This chapter presents the data as three individual case narratives, one for each public school system under the headings system overview, participant stages of use of 21\textsuperscript{st} century technology, and factors that influence the adoption of an innovation. The narratives are based on the descriptive data from the participants’ own words and perspective.

All three systems share many of the same goals of developing a cadre of school-based teaching and learning school technology coordinators to act as technology mentors to teachers at their schools to integrate technology into teaching and learning to improve student achievement while being lead by specific guidelines outlined in IMPACT and using rubrics developed with other state school systems.

System Overview

System One

The first system is made up of twelve schools consisting of grades Pre-K through 12\textsuperscript{th} Grade. The system has around 7,200 students. The goal for this system with the 21\textsuperscript{st} century project was to help science teachers in grades 7-10 integrate technology into their teaching practice by providing the technology personnel, resources, and access necessary to implement an outstanding technology program. The predicted outcomes from the project included: a) the provision of specialized professional development for teachers, b) documentation of mentoring activities completed by school technology coordinators, c) using technology to collect data that will ultimately drive instruction and impact student achievement using the D3M (data-driven decision-making) model, and d) a change in teaching practices that includes the use of technology to impact student achievement, specifically:

1) Students will become increasingly proficient in acquiring the scientific knowledge base needed to master course content and score in the proficient range on the new science test. This skill acquisition will provide the foundation from 7\textsuperscript{th} grade Life
Science to master the high school biology needed to pass the new biology section of the AHSGE (Alabama High School Graduation Exam).

2) Enhancement of existing technology, acquisition of new technology, and the professional development to integrate the technology into the 7th – 10th grade science curriculum will provide a variety of teaching strategies to increase learning and differentiate to accommodate learning modalities.

3) Test scores drop significantly in the 7th and 8th grades and 9th grade students receive no standardized, norm-referenced tests. It is predicted that when the 10th grade students are initially given the new Biology section of the AHSGE, they will score below their potential. By using 21st century tools to reform the classrooms in these grades and excite students about learning, it is anticipated that students will master course content and demonstrate this mastery in their grade appropriate standardized tests.

The funding supplied by the EETT grant outfitted 16 classrooms in the system with 21st century technology equipment. Each of the sixteen classrooms was outfitted with a tablet PC, document camera, mounted LCD projector, DVD/VCR, sound enhancement system, student response system, wireless slate, and projector screen. A set of 30 GPS handheld devices were also purchased for each school targeted in the grant.

The participants in system one included the technology coordinator, and two teachers involved in the 21st century project. The technology coordinator (TC-1) has 25 years of educational experience. Teacher (T A-1) has 23 years of educational experience. Teacher (T B-1) has twelve years of educational experience.

System Two

The second system is made up of fifteen schools consisting of grades Pre-K through 12th Grade. The system has around 10,200 students. The goal for this system with the 21st century
project was to help middle school teachers integrate technology into their teaching practice by providing the technology personnel, resources, and access necessary to implement an outstanding technology program. The system also wanted to provide the necessary personnel, resources, access, professional development, and student instruction to produce technologically literate students by the eighth grade. The predicted outcomes from the project included: a) the provision of specialized professional development for teachers and establishment of an effective mentoring program, b) documentation of mentoring activities completed by school technology coordinators, c) using technology to collect data that will ultimately drive instruction and impact student achievement using the D3M (data-driven decision-making) model, and d) a change in teaching practices that include the use of technology to impact student achievement, specifically:

- Students in grades 6-8 will show an increase in reading comprehension as measured by the Stanford-10 and ARMT.
- Students in grades 6-8 will show an increase in higher-order thinking skills and math problem solving as measured by the Stanford-10 and ARMT.
- Teachers and students will show an increased use of technology as documented by teacher lesson plans, student projects, and the annual IMPACT survey.
- Teachers and administrators will increase the level of technology integration in core curricular areas as documented by lesson plans and IMPACT survey data.
- Teachers and administrators will use technology to examine achievement data and make data-driven decisions regarding instruction.
- Teachers, administrators, and students will meet state standards for technology as measured by the IMPACT survey.

The funding supplied by the EETT grant outfitted eight classrooms in the system with 21st century technology equipment. Each of the eight classrooms was outfitted with a tablet PC, document camera, mounted LCD projector, sound enhancement system, student response system,
wireless slate, and a projector screen. A set of 30 GPS handheld devices were also purchased for each school targeted in the grant.

The participants in system two included the technology coordinator and two teachers involved in the 21st century project. The technology coordinator (TC-2) has eight years of educational experience. Teacher (T A-2) has twelve years of educational experience. Teacher (T B-2) has six years of educational experience.

System Three

The third system is made up of four schools consisting of grades K-12th Grade. The system has around 1,600 students. The goal for this system with the 21st century project was to help middle school teachers integrate technology into their teaching practice by providing the technology personnel, resources, and access necessary to implement an outstanding technology program. The system also wanted to provide the necessary personnel, resources, access, professional development, and student instruction to produce technologically literate students by the eighth grade. The predicted outcomes from the project included: a) the provision of specialized professional development for teachers and establishment of an effective mentoring program and information portal for the sharing of lessons and best practices; b) the procurement of hardware to outfit sixteen classrooms with 21st century technologies; c) documentation of mentoring activities completed by school technology coordinators; d) using technology to collect data that will ultimately drive instruction and impact student achievement using the D3M (data-driven decision-making) model; and e) a change in teaching practices that include the use of technology to impact student achievement, specifically:

- Students in grades 6-8 will show an increase in reading comprehension as measured by the Stanford-10 and ARMT.
- Students in grades 6-8 will show an increase in higher-order thinking skills and math problem solving as measured by the Stanford-10 and ARMT.
• Teachers and students will show an increased use of technology as documented by teacher lesson plans, student projects, and the annual IMPACT survey.

• Teachers and administrators will increase the level of technology integration in core curricular areas as documented by lesson plans and IMPACT survey data.

• Teachers and administrators will use technology to examine achievement data and make data-driven decisions regarding instruction.

• Teachers, administrators, and students will meet state standards for technology as measured by the IMPACT survey and the system technology rubric.

The funding supplied by the EETT grant outfitted 16 classrooms in the system with 21st century technology equipment. Each of the eight classrooms were outfitted with a dedicated teacher computer, document camera, mounted LCD projector, sound enhancement system, student response system, wireless slate, and a projector screen. A set of 30 GPS handheld devices were also purchased for each school targeted in the grant.

The participants in system three included the technology coordinator, and two teachers involved in the 21st century project. The technology coordinator (TC 3) has fifteen years of educational experience. Teacher (T A-3) has fifteen years of educational experience. Teacher (T B-3) has ten years of educational experience.

The research questions that guided this study sought to understand teacher perceptions of innovation and change regarding the 21st century project discussed in this dissertation. The literature review in Chapter II discussed technology in education, various models of change and innovation, and revealed factors that influence the adoption of an innovation. The coding of the data from each system revealed that the factors that influence the adoption of an innovation fall into three categories: a) individual characteristics of the participants, b) characteristics of the innovation itself, and c) characteristics of the setting or culture. What are the teacher perceptions of innovation and change regarding technology integration? This question revealed individual characteristics of participants
and characteristics of the innovation. How has the technology supplied with the grant changed the classroom atmosphere? This question revealed how the characteristics of the setting can affect adoption of an innovation. How has the staff development provided with the project encouraged teachers to collaborate and become part of a professional learning community? This question also revealed how the characteristics of the setting or culture affected the adoption of an innovation.

*Participant Stages of Use of 21st Century Technology*

The in-depth interviews of the technology coordinator and teachers from each system revealed what stages/levels of use each represented from the models of change discussed in detail in Chapter II. Table 12 outlines the stages of use of participants in each district through three models. Table 12.

### Stages of Use of Participants in Each System

<table>
<thead>
<tr>
<th>Participant</th>
<th>Rogers/ Diffusion Theory</th>
<th>Hall &amp; Hord/CBAM</th>
<th>Sherry, Billig, Tavalin &amp; Gibson/Technology Adoption Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology Coordinator (TC-1)</td>
<td>Confirmation</td>
<td>Integration</td>
<td>Stage 5: Teacher as Leader</td>
</tr>
<tr>
<td>Teacher A – (T A-1)</td>
<td>Implementation</td>
<td>Routine</td>
<td>Stage 3: Teacher as Co-Learner</td>
</tr>
<tr>
<td>Teacher B – (T B-1)</td>
<td>Implementation</td>
<td>Refinement</td>
<td>Stage 4: Teacher as Reaffirmer or Rejecter</td>
</tr>
<tr>
<td>Technology Coordinator - (TC-2)</td>
<td>Confirmation</td>
<td>Renewal</td>
<td>Stage 5: Teacher as Leader</td>
</tr>
<tr>
<td>Teacher A - (T A-2)</td>
<td>Implementation</td>
<td>Refinement</td>
<td>Stage 3: Teacher as Co-Learner</td>
</tr>
<tr>
<td>Teacher B - (T B-2)</td>
<td>Implementation</td>
<td>Integration</td>
<td>Stage 4: Teacher as Reaffirmer or Rejecter</td>
</tr>
<tr>
<td>Technology Coordinator – (TC 3)</td>
<td>Confirmation</td>
<td>Integration</td>
<td>Stage 5: Teacher as Leader</td>
</tr>
<tr>
<td>Teacher A – (T A-3)</td>
<td>Decision</td>
<td>Routine</td>
<td>Stage 3: Teacher as Co-Learner</td>
</tr>
</tbody>
</table>
Teacher B – (T B-3) Implementation Routine Stage 3: Teacher as Co-Learner
(Hall & Hord, 1987; Rogers, 2003; Sherry et al., 2000)

System One

The technology coordinator (TC-1) from system one is in the last stage confirmation of Rogers’ Diffusion Theory. The coordinator expressed a unified vision across the system for how technology can improve student achievement. The technology coordinator stated, “My vision that I have is on teachers helping teachers, one person can’t do it all, and one person cannot educate all their students. It’s going to have to be all teachers, administrators, and staff working together to have a productive human being.” System one focused the technology in the grade 7-12 science classrooms. The technology coordinator also stated, “…our main goal was to improve student achievement not to make teaching easier but to draw out the interest in the students for science and to get them to pay attention and to get them to enjoy learning because if you enjoy learning, your retention is going to be there after the teacher is gone.” The unified vision of the technology coordinator seems evident in the confirmation stage in Rogers Diffusion Model.

The technology coordinator (TC-1) fell easily into the integration stage of the CBAM model. TC-1 makes deliberate efforts to coordinate with others in using the innovation. The leadership of the TC-1 is evident from the in-depth interviews, Enhancing Education through Technology (EETT) grant, and field notes. The TC-1 keeps all stakeholders in the system informed about technology. The TC-1 stated, “…I like to keep all our stakeholders involved with decision making and I want them to know what I am doing because I really like to know and keep up with what they are doing so our technology won’t get behind to keep up with their needs.”

The technology coordinator falls into Stage 5: Teacher as Leader in the technology adoption model. The technology coordinator in each system has the opportunity to lead technology change for the whole system. The experience of the TC-1 reveals that educational experience is evident in the 10 years of experience as technology coordinator, and previous experience stated as, “….I was a
classroom teacher. I taught 8th grade a long time and then I moved to the high school teaching Algebra and Computer Science.”

Teacher A-1 is in the implementation stage of Rogers’ Diffusion Theory. Teacher A-1 views technology as a relevant tool for teaching and learning. Teacher A-1 stated, “…there are just so many different things that you can do with this technology. I mean it has just absolutely opened up a whole new world of what you can do.” He also talked about the importance of educational reform in regards to technology. He also stated, “It [technology] just opens up so many more areas and so many more opportunities in the classroom for us as a teacher to give new information, to allow kids to have hands-on learning capabilities and thinking from a technology standpoint it has to be done.”

In Roger’s diffusion theory (1995) the “implementation” stage reveals a shift toward student-directed integration that allows students to master higher-order thinking skills, complex concepts, and skills they may not have otherwise encountered without technology. Teacher A-1 discussed how he thinks technology plays an important part in preparing students for the future job force. He stated, “…working with technology provides the students with more real-world applications.”

Teacher A-1 falls in the “routine” stage of Hall and Hord’s (1987) CBAM model. This teacher is in the middle of the levels of use, and has not yet reached one of the higher levels of CBAM. The routine stage identifies users as making few or no changes and has established a pattern of use. While the teacher integrates technology, he/she has not moved beyond the basic use of the innovation. Teacher A-1 expressed much excitement in talking about using the technology, but his actual use just skims the surface of what can be done with the technology. He mentioned that “…my lecture PowerPoints come from the Internet.” He talked about how great the document camera is for showing student work. In the observation of his classroom, he demonstrated using the document camera to measure items using a metric ruler. While using the document camera to zoom in on the ruler to talk about measurement is beneficial for all students to see better, the actual use of the rulers
was used just to record items on a paper worksheet. This teacher has just started to see how most of this equipment is beneficial for student use, but clearly on a basic level.

According to the technology adoption model of Sherry et al. (2000), Teacher A-1 is in *Stage 3: Teacher as Co-Learner*. Stage 3 as a developmental stage reveals that teachers focus on developing a clear relationship between technology and the curriculum, rather than concentrating on task management aspects. Teachers as this stage often use online resources to enhance instruction. Teacher A-1 mentions using resources from the Internet to expand on his science curriculum. He stated, “...as far as just lessons from day to day most of my lectures now are PowerPoint presentations and I didn’t have to do any of them. I just got on-line and found them.”

Teacher B-1 is in the *implementation* stage of Rogers’ Diffusion model (1995) like Teacher A-1. Teachers in this stage may begin to design learning experiences and environments involving technology that will assist in achieving objectives and outcomes. Teacher B-1 stated, “21st century media is used daily in my classroom and in planning instruction. I use the InterWrite Board, Elmo, and projector daily to explain new concepts or review previous lessons.” This stage for teachers shows students learning complex concepts that they might not have seen without the use of technology. An example given by Teacher B-1 in the in-depth interview that matches this stage is a story given by the teacher about how students reacted to a traditional lesson of “building a battery” when expanded on with the newly installed technology. The teacher stated, “...visual experiences were much better using the Elmo, and the ability to pass the InterWrite board from one group to another to share lab results was amazing!”

Teacher B-1 is in the *refinement* stage according to Hall and Hord (1987). In this stage, the user makes changes to increase outcomes. The teacher changes the innovation to suit his/her needs. The 21st century technology led this teacher to change her teaching style. She reported, “I no longer view teaching as a classroom with a chalkboard and lecture instruction. Hands-on learning with the use of technology enables students to gain the real-world experiences that they need in order to
function in society.” She reported that the students “feel they have ownership in the classroom by being able to use the technology equipment.”

In the technology adoption model, teacher B-1 falls in Stage 4: Teacher as Reaffirmer or Rejecter. According to Sherry et al. (2000), Stage 4 teachers develop a greater awareness of learning outcomes. Students seemed more engaged and spent more time and task when teachers reach Stage 4 of the adoption model. Teacher B-1 stated, “Computer technology is a valuable resource to promote learning because students are more engaged, motivated, and feel ownership in the classroom. The observation of this teacher showed students involved in the learning activity with no wasted time present. Students were alert and focused on the teacher during the lesson.

System Two

The technology coordinator (TC-2) from system two is in the last stage, confirmation of Rogers Diffusion Theory. The technology coordinator of this system clearly defined his vision for 21st century technology. The technology coordinator stated,

...ultimately, we have to change, there has to be a major paradigm shift because we have got to move from guide adapted teaching to teacher being the facilitator of instruction or learning. Where children are actually creating their own content and sharing that content as opposed to being fed the content. So, I think that is where technology’s role becomes increasingly important in the classroom so that the technology is infused in everything we do, and it is a normal part of the day. It’s not, ‘Okay, now it’s time to go to the computer to do this’, it’s just part of the natural, normal day and so that’s kind of where I would like to see us be at some point in time.

The technology coordinator (TC-2) is in the “renewal” stage of the CBAM model. According to this level of use in the CBAM model, the user is seeking more effective alternatives to the established use of the innovation (Hall & Hord, 1987). TC-2 has developed a clear vision for making technology a very important part of his system. The leadership of this technology coordinator is evident after the in-depth interview, EETT grant application, and field notes. He often stressed how important technology is in educational reform and how technology should be a seamless integration into the existing curriculum. The technology coordinator (TC-2) stated, “The
vision is there and we have explained the vision, and we have talked about the vision, and our faculty and staff believe in the vision.” The CBAM and the diffusion model rely on understanding the change process as an important part of accepting the innovation. He changed his original perception of the value of interactive boards in the second year of implementation. He originally advocated that the interactive whiteboard was not as valuable as a teaching resource compared to the interactive slate technology. The interactive slate allows for the movement of the teacher around the classroom without being tied to the board. He recently altered his belief about the usefulness of the interactive boards. He stated in the in-depth interview, “It has always been my belief that we should be getting people away from the board, interacting collaboratively in small groups in the classroom, but I saw the value of interactive white boards probably about six or eight months ago, so I was actually, I guess you can call me a convert.”

The technology coordinator (TC-2) easily falls into Stage 5: Teacher as Leader of Sherry’s Technology Adoption Model (2000). He actively leads his system in acquiring and implementing technology innovations. He explained, “…but I think it takes somebody that has a huge vision about transforming education to be able to do it and you just have to keep pushing forward and I think it was, a poem called, Here’s to the Crazy Ones, you know, the ones that are out there, that they are bucking the system all the time, but it’s those people that are getting things done and so, you look to those people to say, ‘Hey, come help us with this.’”

Teacher A-2 from system two falls into the implementation stage of Rogers’ Diffusion Model. In this stage, the use of technology is used to allow students to think more critically. Teacher A-2 explained, “…we’ve got to teach them how to use technology and to have critical thinking, not be dependent.” Student-directed integration occurs at this stage. The teacher gives an example, “I hook them by bringing in insects and unique animals that they haven’t seen before and we put them on the Elmo every day and we look at them and I get them ready for the graduation exam. I’ll say, ‘Okay, is this an insect or is it not an insect? Why?’ …and it’s like, now I have kids
bringing me bugs every day because I can put it on the Elmo and they can see it live and they can see it large.”

According to Hall and Hord’s CBAM model (1987), teacher A-2 is in the refinement stage which is characterized by the user making changes to increase outcomes. Teacher A-2 has not been reluctant about using technology to catch her students’ attention. She stated, “…in fact, if you don’t use the technology, you lose them. So, it definitely engages them and they love it and they actually respond. You can talk to them about things that they are familiar with and they can teach me things still.”

Teacher A-2 is in Stage 3: Teacher as Co-Learner in the Technology Adoption Model of Sherry et al. (2000). This teacher revealed throughout the interview process that she uses technology daily, and she believes it is important for student learning. She gave an example of using the PRS clickers, “They love to use the PRS remotes, I mean they get excited when, if I have them sitting out and I haven’t put them away, they are like, ‘Are we going to use them today?’ You know, so it’s just part of the classroom.” She has a clear desire to use technology in her classroom, and she does not hesitate in using many different forms of technology to “I use the technology to catch them and hook them.”

Teacher B-2 from system two falls in the implementation stage of the diffusion theory. She stressed during the in-depth interview that technology has forced her to change her teaching style. She uses technology when designing her learning experiences in the classroom. She stated, “…it [technology] keeps you from getting in a rut, because there is so much stuff, new stuff, you’re constantly searching and you’re finding new things. So it gets you out of that textbook rut.”

Teacher B-2 falls into the integration stage of the CBAM levels of use. She has taken upon herself to help others use the technology. She worked closely with her teaching cohort last year to develop and share lessons with each other. At the beginning of this school year, she trained other teachers in the system on using the Elmo document camera.
Teacher B-2 falls into Stage 4: Teacher as Reaffirmer or Rejecter of the Technology Adoption Model. She is a strong advocate of using technology to break down the traditional walls in her classroom, and expand the learning outcomes of students by using resources on the Internet. She gave me an example of one such activity, “We do a lot of stuff on the Internet, like yesterday we were talking about space travel, and I found a virtual rocket, and we launched a virtual rocket. The simulation was very realistic, and it had a mission control center, and we did the countdown and launched the rocket and that is a multistage rocket and it showed each and every stage until we positioned our satellite in orbit, so that was awesome!”

System Three

The technology coordinator (TC 3) from system three is in the confirmation stage of the diffusion theory. This technology coordinator, just like the two others from the first two systems not only has a unified vision for technology use, but she shares that vision with others. She stated,

Our whole vision, the whole time has been, for this technology integration to be a seamless integration, not to be an add-on, not to be, ‘Let’s make the kids all do a PowerPoint as an end project for using technology,’ not to say that, you know, at some point, there is a beginning and that might be useful, but that is not where technologies going to be effective in the classroom. For technology to be effective, it has to be seamless, it has got to be seen, just like the book, the pencil, and the paper in that classroom as the tool to get to the end and the end is the learning that takes place.

The technology coordinator (TC 3) falls into the integration stage of the CBAM levels of use. The integration stage reveals that deliberate efforts to coordinate with others in using the innovation are evident for this technology coordinator. The three technology coordinators involved in this project deliberately coordinated with each other to write the EETT grant.

The technology coordinator for system three fits into Stage 5: Teacher as Leader of the technology adoption model. She has expanded her role in the education field from being a classroom teacher to the system technology coordinator. She stated, “…I’m passionate about technology and I try to infuse that passion in my teachers.” She led her system into using technology.
little technology before she became the technology coordinator. She uses evaluation procedures tied
to the grant to gather data about student achievement in regards to technology use.

Teacher A-3 falls into the decision stage of the diffusion theory by Rogers (2003). At the
decision stage the teacher chooses to accept or reject the new changes. This teacher uses the
technology to assist with traditional tasks that can enrich the curriculum. She gave an example of a
new project that she did,

Well, I try to incorporate new projects. Like last year, we have laptops that we can check out
and so with my juniors and seniors, I just checked out all 25 and I gave them a project. They
had to go out and take digital cameras and they had to bring back the card load it on the
computer and they had to incorporate it into our map. They were doing comic sections,
taking pictures of comic sections. Just trying to get them to use the computer more and then
they had to present it with music. It was a good project. I also make my seniors turn in some
homework assignments online to get them used to doing that because they will be doing it in
college.

Teacher A-3 is in the routine stage of the CBAM model. She uses the technology to make
her traditional lessons more appealing with an established pattern of use. She mentions how the
technology has made her lesson planning easier. She stated, “If I need to graph something like I do
with my 9 through 12, I can just pull up graph paper quickly and then graph it real fast for them
[students]. So definitely, I can go faster with it [technology].”

Teacher A-3 falls into Stage 3: Teacher as Co-Learner of the technology adoption model.
She seems to have a clear relationship between technology and the curriculum. She gave an example
of how she uses the “clickers” in her classroom. She stated, “I mainly use the clickers to see if they
know the objective and the feedback is instant. I use it to see if the class is getting the concept or I
need to re-teach it.” She mentioned during the interview, “I use it every day and I don’t like it when
I can’t use it.” She has matched the technology with her curriculum, but she doesn’t seem to try
activities that encourage critical thinking skills.

Teacher B-3 is in the decision stage of the diffusion theory. The decision stage identifies a
teacher who connects technology to the curriculum. She has chosen to accept the innovation in her
classroom, but the technology is used in a traditional manner of teaching. An example of this that she gave was using the Elmo document camera. She stated, “I will use the Elmo camera and take one of their [student] papers and put it under there and we check their work and they don’t know which one I’m going to pick. They love using the document camera.” This same thing has been done traditionally using overhead projectors with transparencies.

Teacher B-3 is in the routine stage of the CBAM model like Teacher A-3. She exhibits a traditional pattern of use with the technology. An example given by the teacher using the technology with the software that goes with the interactive slate revealed a traditional concept explained using the technology. She stated, “…it is so good for the lessons to be right there and I pull in, do the graphs. It is wonderful with the positive and negative integers, you can plot those. It’s big, everybody sees it.”

Teacher B-3 is in Stage 3: Teacher as Co-Learner of the technology adoption model. The teacher in this stage is still in the learning process regarding technology, but she connects the technology with the curriculum. Teacher B-3 was reluctant at first to try the technology, but she quickly agreed to try using it because, she stated, “I saw the advantage of it and I think it does make a difference with the students, big time.” The advantage to the students seems to be important for her to learn how to use it in her classroom.

Factors that Influence the Adoption of an Innovation

Most theories share three characteristics that might influence the adoption/diffusion of an innovation. Fullan (2005, 2007) has stated that these characteristics are foundation drivers of change. The three characteristics are a) individual characteristics, b) characteristics that are specific to the innovation, and c) characteristics of the setting or culture.

**Individual Characteristics**

Individual characteristics that predispose a person to seek out or shun change have been characterized by Rogers (1995, 2003), who found that individuals could be divided into five groups
based upon their degree of innovativeness. A normal frequency distribution can be divided into a) innovators, b) early adopters, c) early majority, d) later majority, and e) laggards.

System One. The analysis of the in-depth interviews, field notes, and archival records from System One reveals that the technology coordinator one (TC-1) falls into the early adopter category. She has ten years experience as being the technology coordinator, and she is definitely part of the existing social system. Her leadership capability is present in her current position with the system which coincides with the early adopter category descriptions. She not only provides leadership for the integration of technology, but she is a mentor to her teachers. She stated to one of her teachers, “…just give it a chance. Try it and see how you like it. I think if you start using some of this stuff, you will realize it makes your day easier and it makes it more interesting not only for the kids, but for you.”

Teacher A-1 would be considered falling into the early majority category. He agreed to try the new technology upon the advice from the technology coordinator. He stated, “It’s kind of been a breath of fresh air, as far as me having done this for twenty four years, now I feel like I’m doing different things now as a teacher than I was doing just five years ago. So every day is a little different.” Teacher A-1 was hesitant at first in adopting the technology, but with the mentoring from the system technology coordinator he stated, “…this has really made a difference.”

Teacher B-1 falls into the early majority adopter category like Teacher A-1. This teacher showed eager acceptance of the technology. She believes that educational reform is necessary to benefit students. She stated, “I feel that teachers must be continuous learners in order to provide beneficial instruction for our students.” She expressed willingness to change as an important part of the educational profession. She stated, “With technology and new discoveries being made daily. I feel that it is very important for teachers to attend workshops, classes, view websites, journals, and any other information resources that are available in order to stay current on their subject area.”
**System Two.** Based on the data collected during the in-depth interviews, field notes, and other archival data the technology coordinator (TC-2) would fall into the early adopter category like the system one technology coordinator. He has eight years of experience as the technology coordinator, and he is an active member of the social system. The technology coordinator (TC-2) provides leadership and guidance to all employees of the system regarding technology integration and innovation. He collaborates with other system leaders to inform all the stakeholders of how important technology can be in the classroom. He stated, “One of the biggest effects of the project has been that we all come together and talk about how technology can leverage classroom instruction.”

Teacher A-2 would fall into the early majority adopter category. She willingly adopted the technology innovation in her classroom. She stated her reason for adopting the technology as, “…it definitely engages them and they love it and, you can talk to them about things that they are familiar with and they can teach me things still.”

Teacher B-2 would fall into the early majority adopter category like teacher A-2. She was excited and very accepting of the new technology. She talks about how she uses the technology every day. She states, “I use it in every subject. I use a lot of Internet resources, it’s fantastic just to be able to have it a click away.”

**System Three.** Technology coordinator (TC 3) falls into the early adopter category just like in system one and two. She has three years experience as the technology coordinator in her present system. She has twelve years of experience in a previous system. She brought in most of the technology in this system. She stated, “When I got here three years ago, they had no technology, I mean, they had a computer in their classrooms and that is all they had.” She has provided true leadership in the adoption of the technology in her system. She not only provides leadership and guidance in her system, but she is a mentor to all employees of the system.
Teacher A-3 falls into the early majority category. She showed deliberate willingness to adopt the technology. She stated, “I like updating things, I like the new stuff. I like the challenge. I guess I can’t say I like change in everything, but in technology I do.” She believes that it is important for her students to have experience with technology, because she stated, “…if we don’t give them some access to computers when they go to college, that is all it is. A lot of college professors require everything online and if they have never used it, then that is going to be one more thing to overcome in college.”

Teacher B-3 falls into the early majority adopters’ category just like the other teachers in all the systems. She admits to taking the technology and starting to use it the first day. She stated, “I use it every day, every period of every day and I love it!” She expressed her willingness to adopt the innovation throughout the interview.

The teachers that were involved with the 21st century project were all willing participants. They were asked within each system if they would like to be a part of this project. The decision to adopt the innovation was not a difficult one for all the participants because they were chosen based on criteria determined by leadership in the system and personal consent by each member. The last categories described by Rogers which make up the later majority adopters and the laggards do not apply to the participants in this group because of the way they were chosen (1995, 2003).

Engaging Moral Purpose

According to Fullan (2005, 2007), engaging moral purpose falls under the individual characteristics that can affect or influence the adoption/diffusion of an innovation. Moral purpose in educational change is about improving society through educational systems and thus the learning of all citizens. The moral purpose is associated with the acceptance of educational reform. The first research question of this study is to possibly answer what are the teacher perceptions of innovation and change. Themes that emerged that relate to engaging moral purpose included acceptance of educational reform and having a vision for how technology can improve education.
System One. The in-depth interviews started with each participant answering the question, “Do you feel educational reform is necessary?” The technology coordinator (TC-1) answered, “It is a must, I just think a must, which it is very important, and 21st century technology is here, it is a must that our teachers stay up with the times. We have to prepare our students to go to college…I’m just a champion for technology.”

Teacher A-1 stated,

I think in certain aspects of educational reform it is not only necessary, it is absolute. I think it has to happen, technology being a great example of that. It just opens up so many more areas and so many more opportunities in the classroom for us as a teacher to give new information, to allow kids to have hands-on learning capabilities and thinking from a technology standpoint it has to be done. So many more jobs now are technology related that kids need access to that while they are here, so it is not a shock to them when they get in the workforce.

Teacher B-1 stated, “I firmly believe that educational reform is necessary in education.” She has embraced the new technology in her classroom with open arms. She admits to using every piece of equipment provided through the EETT grant.

System Two. Teacher A-2 in response to the question about how they felt about educational reform stated, “Definitely with technology. Some of the programs and changes that have come through, I can’t say that I liked, but the technology, most definitely because the students don’t respond to the old methods anymore.”

Teacher B-2 answered the same question, concerning whether change is necessary a lot of times in education, and she answered, “Yes, yes, it is. It is. I mean, it’s not always welcome. I mean, it comes a time when it has to be done.”
System Three. The technology coordinator (TC 3) stated about educational change,

Oh, without a doubt, because the one thing that technology does that paper, pencil, and books can’t do to the extent that technology can, is that collaborative learning and employers say today that the skills that they need students to have, that they are not having, they are not prepared, are those communication skills and those collaborative skills in being a team-player. Well, if you are doing a lot of group projects using your technology, then you are going to instill that in these students.

Teacher B-3 answers the same question about education reform. She stated, “I do. I do because it has really involved our students because it has really made it so much better for them.”

The acceptance of an innovation is one of the drivers of change outlined by Fullan as engaging moral purpose (2004). The willingness of educators to accept and embrace an innovation is an important step in improving educational systems.

Knowledge, Skills, and Attitudes of Individuals

Knowledge, skills, and attitudes of individuals are also factors influencing the adoption of an innovation. This relates to how staff development plays a role in the systematic attempt to bring about change. According to Guskey (1986), a) change should be recognized as a gradual and difficult process for teachers, b) teachers should receive regular feedback on student learning progress, and c) continued support and follow-up after the initial training should be provided.

All three systems share the same goals for professional development. One of the focuses of the 21st century project between the three systems was that teachers do not have adequate opportunities for collaboration and that collaboration is essential to growth and change. By forming a professional development partnership, all three school systems were able to pool resources, allowing for more teacher training and collaboration among teachers in the formation of projects that are technology imbedded. Themes that emerged were teachers willing to learn, willing to go to professional development, willing to dedicate time to the project, and willing to be part of a collaborative community of continual learning.
System One. In system one the technology coordinator (TC-1) stated, “I just feel like this project was the project to bring all the science teachers together and let them communicate, and let them get together.” The system one teachers realized that with the technology, communication could be easier, and you could communicate from afar and reach out to the world. The technology coordinator also stated, “The professional learning communities, we share, I just could sit back and just smile because they take upon themselves to help each other and get it going.”

Teacher A-I mentioned in the in-depth interview that before the project, “…we used to just come in our classroom, we stayed in our classroom and we didn’t really communicate with a lot of the people outside planning periods or help each other out.” He stated, “All the professional development and everything they’ve provided…it’s been wonderful!”

Teacher B-I also discussed how beneficial the staff development with the 21st century project had been for her. She stated, “…it has been very beneficial for me regarding the use of technology in my classroom. The training offered during the summer on the use of GPS units made me feel more comfortable using technology that I was not familiar with, made me feel connected with my peers, and part of a learning community.”

System Two. The technology coordinator (TC-2) understands how important staff development is in getting teachers to adopt an innovation. He stated, “We know it’s got to be sustained, it has to be ongoing, it has to be long term, and it has to be all those things for professional development.” He made sure to include funding in the grant application to pay for substitutes for teachers to be trained. He stated also, “staff development is the only way that it is going to change classrooms.” He believes that professional development for teachers and administrators must change. He believes that professional development should not be “sit and get” sessions, but it should be hands-on and modeled for teachers so they can understand the implications and what must take place to systemically change instruction. In archival data collected during the study, he stated, “Leaders must be actively engaged in understanding new learning environments and how students
learn, and they must receive high-quality professional development that helps them engage in new conversations about what takes place in the classroom and how brain research shows that our students learn differently than we do.” He believes if professional development is presented systemically and over time it can help teachers and administrators create a new vision for today’s classrooms, and that it will help engage students in ways that are more meaningful. Professional development is considered important in the EETT grant process as well. It is required by the grant that at least 25% of the grant has to be spent on professional development.

System Three. Teacher A-3 believes that the staff development provided with the 21st century project was very important. She stated, “I think that just seeing others excited about it from different schools and that they are trying things. The 21st century project training that we had between the three systems let us see that some teachers had already done different things with it and that I had not even thought about. So it, kind of challenged me to do more and I think that it is a good thing.”

All three systems used the professional development to train teachers how to use the equipment to improve student academic achievement through the effective use of technology in their curriculum. The project design included onsite technical and instructional support that is provided by the teacher/technology cadre. Currently, the project is moving toward innovation by continuing professional development and implementing classroom strategies using technology for teaching and learning.

Characteristics of the Innovation

The Stages of Concern of the CBAM model takes into account the individual’s feelings and concerns about an innovation (Hord et al., 1987). The Stages of Concern of the CBAM model maps the process of stages that participants may go through that can influence the adoption of an innovation.

System One. The technology coordinator (TC 1) can be considered a leader and mentor for the teachers in the system. She understands the individual characteristics of her teachers, and she
guides the change process in technology integration. She would be at the refocusing stage of the CBAM model. She encourages her teachers to research and test new ideas and technologies. She provided access to the 21st century technology in her targeted grade 7-12 science classrooms. She provides site support to all her teachers with local school technology coordinators. She meets with these school technology coordinators once a month to maintain a system professional learning community.

Teacher A-1 from system one could be categorized into the collaborative category of the CBAM stages of concern. He wants to share lessons with other teachers, and he collaborates with others concerning lessons for his own classes. He stated, “There are just so many things that we’ve been able to help each other with because of this project. Collaboration is beneficial, very beneficial for us.”

Teacher B-1 could be placed in the “collaborative” stages of use just like teacher A-1. She states, “I have collaborated with several science teachers developing tests for lab safety using the clickers.” She offers technical support to other teachers in her building regarding the technology.

System Two. The technology coordinator (TC-2) is a leader and mentor for his system like the technology coordinator in system one. He provides access to all resources so the teachers can refine their ideas and put them into practice. He would fall into the “refocusing” stage of the CBAM model. He works closely with all employees in his system while providing technical and sustained professional support for integrating technology.

Teacher A-2 from system two could be categorized into the collaborative category of the CBAM stages of concern. She offers technical support to other teachers in her building. She stated, “I’m the hallway technology coordinator and I help when things aren’t working, and I get asked a lot of questions.”

Teacher B-2 would fall into the collaborative category like teacher A-2 in her system. She works with other teachers in her school by teaching classes on using various pieces of technology.
She explained that she offered training sessions on the document camera this summer before the start of school. She works with other teachers as a mentor or coach throughout the school year.

*System Three.* The technology coordinator (TC 3) revealed during the in-depth interviews that she brought in most of the technology currently available to her system. She continually collaborates with other technology leaders in the state, and brings back ideas for technology integration and innovation into her system. She stressed throughout the interview and in the grant document how important the integration of technology is in all classrooms, and how it should be seamless.

*Understanding the Change Process*

The overall vision of the 21st Century Project is shared among the three systems involved in the project, along with the teachers that are part of the project. The three technology coordinators believe in an overall vision and agree on the importance of “21st century skills” in the workplace. In addition to requiring advanced skills in reading and math, twenty-first century businesses seek employees with a host of sophisticated skills, including the ability to solve problems, communicate effectively, and think critically, as well as a high degree of technological fluency (Partnership for 21st Century Skills, 2006). Fullan (2004) believes that for change to work you need the energy, ideas, commitment and “ownership” of all those involved in the project. Themes that emerged were the expression of an overall goal for the project shared among the three systems, and an awareness of the importance of technology.

*System One.* The technology coordinator (TC-1) outlined the prospective grant opportunity to the administrators in her system, and asked the principals to suggest teachers who might be interested in the project and who would be willing to commit to the project. She stated, “Please talk with your science teachers, and outline the 21st century technology that will be purchased, explain the professional development planned with the project, and explain that the training and implementation
of the equipment will be mandatory.” If the teachers agreed to the requirements of the project, they signed the consent form, thereby expressing their commitment to the project.

**System Two.** The technology coordinator (TC-2) understands the importance of having the teachers be involved in the project, and for them to feel part of the process. He stated, “…you can put the equipment in all day long, but if you don’t have teachers on board, it won’t work.” He mentioned during the interview that many of his teachers had professional development plans that included technology. He read an email from one of his teachers that stated, “Thank you for your patience in my PDP last year. I put I would learn and use more technology in my classroom this year and so I am getting to do just that. I’m happy to say that I’m already meeting my goals.”

**System Three.** The technology coordinator (TC 3) defined what she considered characteristics of a teacher willing to change and possibly adopt an innovation. She stated, First thing is they’ve got to be willing to learn new things because just learning how to use the equipment takes a little bit of a learning curve. We thought, initially, that younger teachers who have grown up with technology would probably be better at this than some of the old veteran teachers and while that is true to some degree it is not unequivocally true as we thought it might be. We have some older teachers that are just motivated. So, I just think the motivation to learn new things, if teachers are committed to being life-long learners, then they are going to be very successful at integrating technology in their classroom.

Teacher B-3 from system three stated, “I got right on board because I saw the advantage of it, and I think it does make a difference with the students.”

*Characteristics of the Setting or Culture*

Factors that may influence the adoption/diffusion of an innovation can include things involved with individuals, but also include characteristics associated with the setting of the intended innovation or the culture surrounding the innovation. These characteristics can be broken down into sub-categories which include building capacity, resources, professional community/communities of practice, program coherence, and shared leadership.
Building Capacity

Building capacity involves increasing organizational power to adopt the innovation. The capacity building involves the development of new knowledge, new resources, and new shared identity and a motivation to work together to bring about change (Fullan, 2004). Capacity building is often overlooked in the change process. When implementing changes like technology integration it is important to have the support of individuals, teams, and administration because it is not a simple one-step process, but contains stages that cannot be accomplished in a short period time (Hall & Hord, 2006). Themes that emerged were teamwork, collaboration, professional learning community, and a shared vision.

System One. The technology coordinator (TC-1) discussed the importance of building capacity. She stated, “It’s going to have to be all teachers, administrators, and staff working together to make the adoption of an innovation successful.” Building capacity reveals that professional learners value change in increasing their effectiveness of teaching. Teacher B-1 stated, “Computer technology is a valuable resource to promote learning because students are more engaged, motivated, and feel ownership in the classroom.” Teacher A-2 reflected on how the participants involved in the 21st century project share a vision of the overall concept.

System Two. The technology coordinator (TC-2) expressed specific goals for the 21st century project which includes building capacity within his system along with the two other collaborating systems. The partnership between the three systems have allowed for all three technology leaders to share their knowledge and skills by teaching others and allowing the use of additional resources to effectively integrate technology into the curriculum. This project allowed for the development of a technology consortium where everyone involved worked together, shared the same vision, and were motivated to integrate technology.

System Three. The technology coordinator (TC 3) discussed how the collaboration between teachers has progressed in her system through the 21st century project. She mentions that groups of
core content teachers get together not just in one school, but in collaboration with all the schools and they meet and discuss issues and solutions related to technology innovation. The technology coordinator mentioned in the in-depth interview that, “I think the collaboration is the strongest thing that I have noticed with this project.”

Resources

Resources need to include infrastructure, tools, people, money, and the time necessary to adopt the innovation. In the case of the 21st century project, the resources included the equipment purchased; people willing to use the technology; infrastructure which includes the network, cabling, and electricity; and time devoted to professional development resources. All three systems expressed the importance of allocating the appropriate hardware, software, and support to encourage the capacity building process. Themes that emerged were time to build program, equipment purchased, scope and sequence, various funds used, time and money, and classroom setup.

System One. The technology coordinator (TC-1) mentioned how the local school technology coordinators at each school play an important part in system one’s resources. She mentioned how the stakeholders in the system are all involved in the decision process regarding technology. She stated, “…I like to keep all our stakeholders involved with decision-making and I want them to know what I am doing because I really like to know and keep up with what they are doing so our technology won’t get behind to keep up with their needs also.”

System Two. The technology coordinator (TC-2) revealed in the in-depth interview that, “It takes time and it takes personnel and it takes money.” The technology coordinator discussed the 21st century project, stating that it has “brought all the purse string holders together,…we all come together and talk about how can technology leverage classroom instruction.” He mentioned that, “…it’s just about building those relationships and that has been huge.” The pulling together of the resources in system two regarding technology integration, has lead to a “…really interesting piece of it [the project] and so it has leveraged the level of technology in this school system and it has made a
huge difference in awareness for technology, and I think it has changed the Board’s perception of technology. Those are huge effects I think.” The resources provided with the EETT grant have transformed the classrooms in all three systems dramatically. While it is important to have the equipment in each classroom, the technology coordinator (TC-2) stated, “If it’s not working, it is not available and it is not reliable, they [teachers] are not going to use it, so we have spent, really the first three years doing nothing, but that.”

**System Three.** The technology coordinator (TC 3) expressed her understanding of how important the resources are in integrating technology. She stated, “The current learning environment must change; replaced by a learning environment where all students, staff, and administrators have access to the technologies, tools and skills to support seamless, interactive learning.” The physical setting must be conducive to the continuous and changing needs of the learning community. She stated, “The technical infrastructure must support current and future mobile and fixed technical equipment and should enable the sharing of all data types. Classrooms, labs, and other learning spaces must provide the necessary elements that allow for instruction and learning.”

**Professional Community/Communities of Practice**

Professional learning communities ensure that teachers no longer have to work in isolation, share responsibilities, share leadership, share the same vision, and have a desire to improve education for our students. These communities of practice allow for group members to inspire and motivate each other to contribute and implement best ideas for overall coherence (Fullan, 2001). Themes that emerged were shared vision, professional learning communities, desire to improve education and prepare students for the future, and collaboration.

**System One.** The technology coordinator (TC-1) discussed how the three systems collaborated together to form the 21st century project. She stated,

We collaborated with system two and system three, and it was wonderful because our teachers got to see what their teachers were doing. We realized that we have a lot of good ideas coming from our teachers and in turn their teachers had tremendous ideas because a lot
of them had been there, done that and they could say do this, don’t do that, and there was a lot of collaboration and team building and a lot of sharing ideas.

Teacher A-1 discussed how the communication between staff members throughout school talked more frequently due to the technology. He stated, “Collaboration is beneficial, very beneficial for us.”

**System Two.** The technology coordinator (TC-2) discussed how important collaboration was as a clear goal of the 21st century project. He wanted to get the teachers to think outside the four walls of their classrooms and get them involved in the world outside. He stated, “The conversations really started out about how do you use something, but then they kind of evolved into more specific, ‘I believe,’ into, more specific content driven innovative strategies to use the technology.” Teacher A-2 mentioned one of the continuous professional learning communities that happen in the system is called “Tech Talk” or “Tech Tuesdays” where the faculty gets together and demonstrates how technology is being used and answers questions.

**System Three.** The technology coordinator (TC 3) believes that technology can create an atmosphere that allows for learning communities. The collaboration afforded by the technology allows for groups to learn getting along no matter how different each individual may be. She stated, “I think the collaboration is the strongest thing that I’ve noticed as a result of our project.”

**Program Coherence**

The program coherence of technology integration involves the extent to which technology integration is coordinated with clear learning goals over a sustained period of time. Adoption/diffusion of innovations can be complicated and overwhelming without a clear plan on how to accomplish the integration and acceptance of the innovation. Themes that emerged were willingness to change, overall goals, and sustained staff development.

**System One.** The technology coordinator (TC-1) discussed the initial training setup with all three systems. The principals of each school were included in the training sessions. She stated, “The
principals from each one of the schools were invited and we had a session with them to help them know what a 21st century classroom should look like.” As part of the training, the evaluation of the teachers was discussed and how to evaluate the use of technology in each teacher’s classroom was outlined for the principals. She stated, “We went over things to look for, and things to do, and suggestions, and helped them to know what a 21st century classroom looks like and what they should be pushing their teachers toward or helping their teachers toward.”

System Two. The technology coordinator (TC-2) discussed how the goals of the program were designed over a period of time. The knowledge of what infrastructure should be in place before the actual technology equipment was bought was planned over a three year period prior to the implementation of the actual classroom technology. He stated, “We had to build that piece of it, so people would even consider using technology in their classrooms.” The program coherence was not only planned for the teachers, but also for the students who need to meet the technology course of study. A specific program was bought for the system that recorded technology literacy for grade levels throughout the elementary level until eighth grade. He stated, “…the program was chosen based on the need to verify that the technology course of study was being taught.”

System Three. The technology coordinator (TC 3) identified the focus of the 21st century project towards schools that had been identified for school improvement. She believes that technology “…does more than paper, pencil, and books can do, it provides collaborative learning that employers today say is necessary for future employment.” The focus for the project is known by all participants and they share the same vision for the outcomes that technology innovation may affect.

Shared Leadership

According to Lambert (1998), leadership is about learning together, and constructing meaning and knowledge collectively and collaboratively. The responsibility of all members of a professional learning community is to share leadership regarding the overall vision and purpose of the desired goals of the innovation. All three systems worked closely together to develop the 21st
century project. Each of the technology coordinators shared the leadership within their systems while providing leadership across all systems as well. The formation of a collaborative group of school coordinators that operate within and between school systems provided effective professional development in various technology strands. Each system had a specific goal to prepare technology leaders in each system to assist other teachers in integrating technology. Themes that emerged were shared leadership, mentoring, shared vision, teamwork, and teacher leaders.

**System One.** The technology coordinator (TC-1) discussed how the teachers in her system were becoming leaders in their schools, by showing other teachers how changing to a student-led classroom instead of a teacher led-classroom can ultimately improve student achievement. This change in the classroom was spurred by the integration of the technology. Her vision follows the idea that teachers, administrators, and staff will work together for the good of the students and their futures.

**System Two.** The technology coordinator (TC-2) discussed how the 21st century project has nourished the teachers involved in the project to become leaders. He stated, “The teachers that you are going to talk to in the interviews have become leaders in helping their schools move forward with the technology.” He mentioned that principals have also become technology leaders and “…other principals began looking at them for how they were implementing the technology.”

**System Three.** The technology coordinator (TC 3) discussed in the in-depth interview how shared leadership has developed inside her system. She stated, “The shared leadership is not a conscious thing that they are doing, it just sort of permeates because once you start talking about what you are doing, then the others start following, but it is not conscious on their part.”

The results of this study outlined above have attempted to answer the research questions identified in this dissertation research study. This chapter revealed what stage each participant could be categorized as falling in regarding the models of change discussed in Chapter III. The factors that can influence the adoption of an innovation revealed individual characteristics, characteristics of the
innovation, and characteristics of the setting or culture among all three systems that can predict whether an Enhancing Education Through Technology Grant can lead to innovation and change.
CHAPTER V:
DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This research study sought to answer the overall question: Does an Enhancing Education Through Technology Grant lead to innovation and change? The three systems created a consortium that strengthened the ability of all concerned to impact student achievement by pooling resources. The project included four chief components: infrastructure and implementation, professional development and support, classroom teaching and learning, and innovation. Currently, this project is moving toward innovation by continuing professional development and implementing classroom strategies using technology for teaching and learning.

The power of technology was expressed by the three systems in the following statement:

Imagine a small rural school in Alabama where students are required to take and pass a rigorous exam in order to graduate. Imagine sitting in a classroom with a teacher who is very knowledgeable that lectures day after day to make sure that students have the knowledge necessary to pass this exam. Imagine that this teacher has never even sent an email. In 2007, this was a Social Studies class that was taught using a textbook and a course of study and 61.5% of the students passed the social studies portion of the graduation exam on their first attempt. In 2008, the text book and course of study were aligned to assure that all standards were being taught and technology was added to the classroom. The lecturer began adding presentations to his lecture, but no training was done on effectively embedding technology into the curriculum and 75.6% of the students passed the graduation exam on their first attempt. Then, in 2009 training was added and the teacher became more adept at using presentations, streaming media, and annotated notes with his class using a document camera, a wireless slate, and an LCD projector. Collaboration occurred between the classroom teacher and the special education teacher and 85.3% of students passed the graduation exam on their first attempt, including every special education student. The power of technology integration, collaboration, professional development and standards-based learning has led to increased test scores, increased collaboration, and increased student engagement. But, more importantly, it has led to increased teacher engagement.

Discussion

Many research studies have been conducted that address barriers to technology integration (Adams, 2005; Bitner & Bitner, 2002; Ertmer, 1999). These barriers mainly focus on the first order
barriers which are extrinsic to teachers such as lack of time, lack of equipment, and attitude of teacher. This study sought to go beyond the extrinsic barriers of integrating technology and look at the second-order barriers which are more likely persistent and require major changes in daily routines and underlying beliefs (Ertmer, Addison, Lane, Ross, & Woods, 1999). The theoretical framework used for this study revolved around diffusion of innovations, educational change, and the adoption of technology.

A study by Marcinkiewicz (1993), about the diffusion of instructional technology revealed that of the 170 teachers surveyed, only 8% were at the Integration level of diffusion. The rest of the respondents were split fairly evenly between Nonuse (45%) and Utilization (47%). The results from this study revealed that all three technology coordinators (100%) were in the Integration level of diffusion. No teachers (0%) were in the Nonuse level of diffusion. The teachers (100%) in all three districts fell into the Integration level of diffusion. The overall results of this study showed that all participants of this study fell into the top level described by Marcinkiewicz compared to his previous study participants. The acceptance of technology into the classroom has changed since Marcinkiewicz’s study in 1993.

The models of change discussed in detail in Chapter II explored many studies conducted about how educational change and reform have affected the educational system of today. One of those studies discussed was the Apple Classrooms of Tomorrow [ACOT] (ACOT, 1998). The ACOT project demonstrated that technology not only increases the potential for learning but that the use of technology brought about changes in teaching and learning (ACOT). The insights gathered and evaluated by this research study laid the groundwork for technology to be viewed as a catalyst for change and information technology as a vehicle for changing the structure of the traditional classroom (ACOT, 1998; Dwyer, 1994; Holvig & Crisci, 2001). This research study revealed that participant perceptions about educational reform were positive and accepted as a necessary step to prepare students for the future. Participants revealed, “….as far as technology…that is the part of
education we need to change;” “…So many more jobs now are technology related that kids need access to technology….to prepare them for the workforce;” “…21st century technology is here, it is a must that our teachers stay up with the times to prepare our students for the future.”

This study identified teacher perceptions of innovation and change that can fall into three categories and can influence the adoption of an innovation. These three factors are: a) individual characteristics, b) characteristics of the innovation, and c) characteristics of the setting or culture.

**Individual Characteristics**

According to Rogers (2003), there are certain characteristics that can predispose a person to seek out or shun change. The participants in all three systems exhibited strong characteristics towards adopting an innovation. The technology coordinators and the teachers involved in this project all had a choice to be or not to be involved. The desire and willingness to change was obvious by the themes that emerged during the coding of the data. Teachers and technology coordinators continually expressed a willingness to learn how to use the technology, shared the same vision, and had a clear desire to adopt the innovation because they truly believe that it can make a difference in student achievement. The normal frequency distribution described by Rogers (2003), places people in different stages based on their degree of innovativeness. Rogers’ study identifies *Innovators* as being 2.5% of the population, *Early Adopters* as being 13.5% of the population, *Early Majority* as being 34% of the population, *Late Majority* as being 34% of the population, and *Laggards* as being 16% of the population. The current study revealed that all three technology coordinators (100%) fell into the *Early Majority* category. All the teachers from the three systems (100%) fell into the *Early Majority* category. Combining the technology coordinators and the teachers in the distribution reveals that 33% are in the *Early Adopter* category, and 66% are in the *Early Majority* category. The difference in the distributions of Roger’s degree of innovativeness and this study can be accounted for by recognizing the participants in this study entered into the project on a volunteer basis, and they already had a proclivity towards accepting innovations.
Characteristics of the Innovation

The Concerns Based Adoption Model developed by Hall and Hord (1987) has been used to identify the stages of concern, levels of use, and innovation configurations associated with the innovation. The understanding of the change process is imperative to the successful adoption of the innovation. The coding of the data revealed several themes that revealed the participants involved in the 21st century project exhibited energy, new ideas, a commitment and ownership in the success of the project. The themes included transformation of teaching, students involved in the learning, teacher as facilitator, awareness of the importance of technology, and a paradigm shift in how students learn today. The CBAM model has been used in a variety of different settings, but it has mainly been applied to the educational setting to address affective and cognitive concerns of teachers during the change process (Straub, 2009).

A three-year interpretative study (1993-1995) was conducted at a Western Australian private girls’ school to evaluate the implementation of a computer program. The study consisted of 23 teachers. The CBAM model was used in the study and reported that 7 teachers were in the Nonuse level, 2 teachers were in the Orientation level, 3 teachers were in the Preparation level, 6 teachers were in the Mechanical Use level, 2 teachers were in the Routine level, 1 teacher was in the Refinement level, 1 teacher was in the Integration level, and 1 teacher was in the Renewal level (Newhouse, 2001). This study identified the levels of use of the participants involved in the 21st century project. This study revealed that 0 participants were in the Nonuse level, 0 participants were in the Orientation level, 0 participants were in the Preparation level, 0 participants were in the Mechanical Use level, 3 participants were in the Routine level, 2 participants were in the Refinement level, 3 participants were in the Integration level, and 1 participant was in the Renewal level. The results from the Newhouse study showed low-level uses of innovations which helped guide the researcher to develop a model more tailored to the innovation. This research study revealed that the participants involved with this study are more on target with the goal to accepting the innovation.
Characteristics of the Setting or Culture

This study revealed how the characteristics of the setting or culture can play a role in adoption of an innovation. Building capacity is important in the technology adoption process (Newmann et al.,) and the data from this study revealed that all three systems outlined ongoing policies, strategies, and resources that increased the organizational power that brought about change in the classrooms involved in the 21st century project. Themes that emerged from the coding included preparing students for the future, teamwork, shared vision, scope and sequence, and program coherence that are shared by all participants involved in the project.

The professional community is clearly evident after evaluating the data from the in-depth interviews, field notes, and archival data. All three systems collaborated together to apply for the EETT grant which stressed the importance of collaboration among the teachers from each system. They were able to share their knowledge and skills by teaching others while effectively integrating technology into the curriculum. Sustained staff development recommended in the research by Youngs and King (2002) was designed to be implemented throughout the project. Training and support were provided on a continual basis throughout the school year. Training was provided for all individuals in each system that was integral for the success of the project. Technology coordinators, teachers, and administrators from each system are part of the professional learning community. Each member of the project no longer has to work in isolation, and they share responsibilities, share leadership, share the same vision, and desire to help students learn as described by Lambert (1998). The change process can be difficult for individuals, but when they share all aspects of the diffusion/adoption of the innovation it is more likely the innovation will be accepted by all members of the school or system. According to Fullan (2004), knowledge sharing and collective identity are powerful forces for positive change, and they form a core component of our change knowledge.
Implications for Practice

The study identified factors that can influence the adoption/diffusion of an innovation. These findings have implications for other schools or systems that are implementing 21st century technology into traditional classrooms. The understanding of the change process is important for any educational organization if success of the adoption is the desired outcome. Change must be implemented over a period of time, and should not be expected overnight. Change cannot happen in an organization if only a few people support the goals and vision of the project. Change must involve program coherence, shared leadership, and a shared commitment to the success of the program. Recommendations for other systems interested in duplicating the results presented in this study include: alignment of professional development and teacher concerns, allowing teachers a voice in innovation adoption, and understanding the change process.

Alignment of Professional Development and Teacher Concerns

Professional development played a major role in the implementation of the 21st century project described in this study. All three systems involved in this project believe that teachers do not have adequate opportunities for collaboration and that collaboration is essential to growth and change. Professional development was planned, organized, and sustained throughout the project. The teacher concerns were part of the planning process by all three technology coordinators in the original development of the project. The models of change discussed in this study will help other systems begin to consider teacher concerns for diagnosing initial educator levels of technology integration and properly sequencing training activities in order to move teachers to higher levels. According to Dobbs (2005), professional development should be in alignment with the stage of concern in innovation adoption is going to be sustained.

Allowing Teachers a Voice in Innovation Adoption

It is important that when asked to adopt and innovation teachers feel important and involved. The participants in this study were invited to participate after initial selection by administrators in
each system. The project was explained and requirements were identified before the participants agreed to be involved with the 21st century project described in this study. Building capacity among everyone involved in the project is important for the successful adoption of the innovation (Newmann et al., 2000).

**Understanding the Change Process**

Change is not something that happens overnight. The change process can take a long period of time. Teacher buy-in is crucial for sustained innovation implementation (Hall & Hord, 2001) and by acknowledging and addressing feelings of discomfort and teacher concerns through professional development and support, change facilitators can better ensure sustainability of innovations. Hall and Hord (2006) developed twelve principles of change that can be an impetus for external or internal change. These twelve principles can guide systems interested in understanding the change process.

**Recommendations for Further Research**

The implementation of 21st century technology into the educational setting is a national reform that is happening daily. As more and more schools and systems purchase expensive technology to transform traditional classrooms into interactive learning environments, the success of true integration of technology is not guaranteed with just the purchase of the technology. Factors affecting the adoption of the innovation including understanding the needs of individuals affected, understanding the characteristics of the innovation, and understanding the characteristics of the setting are imperative if the technology will be a seamless integration or it will sit in a corner and collect dust.

Some items that need further study are:

1. Including a larger number of participants to lend additional validity to the initial findings of this research.
2. Focusing a similar study on a school or system that implements the 21st century technology into a larger environment where participants are not chosen individually but the technology implementation is wide-spread.

3. Focusing a follow-up study on the same project analyzing student academic achievement in the project classrooms.

Conclusions

In response to the overarching question that guided this study, “Does an Enhancing Education Through Technology Grant lead to innovation and change?” this study found that the consortium developed between the three systems has lead to innovation and change in the chosen classrooms. While these classrooms reveal a positive change in teacher perceptions, the same results might not occur if the technology implementation had been system wide. The participants involved in the present project expressed an initial desire and willingness to accept change, and a system wide implementation might take longer and additional barriers would probably appear. Results from this study have the potential to guide future 21st century technology implementation into the K-12 classrooms.
REFERENCES


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APPENDIX A

INTERVIEW PROTOCOL

Interview: Guided Inquiries for Technology Administrator/Coordinator
1. Describe the vision you have for your school system’s schools regarding the integration of computer-based technology into the curriculum through the 21st Century Project. How important do you feel this educational reform is for the future of our students?
2. Is the 21st century technology an integral part of the overall vision? Please explain your response.
3. What are the characteristics that you perceive a classroom teacher exhibits when effectively integrating computer-based technology into the curriculum?
4. Do you believe that your teachers have a strong belief in adopting technology?
5. How well do your teachers normally accept change? Have the participants involved with this project accepted the philosophy of the 21st Century Project?
6. Please explain how you chose the educators you recommended for the 21st Century Project. Do these teachers seem to understand the importance of imbedding technology and the ramifications on student learning?
7. Is staff development promoting the use of computer-based technology in the school curricula a significant part of the technology plans for your system? Do you see yourself as a technology mentor?
8. Did the professional development provided with the EETT grant allow teachers to become part of a professional learning community? What kinds of collaboration have you noticed with this project?
9. Have you noticed more shared leadership with the implementation of this model?
10. What other effects from the 21st Century Project have you noticed in your schools? Explain.

Interview: Guided Inquiries for Classroom Teacher
1. Do you normally feel that educational reform is necessary, or are you more comfortable with leaving things unchanged?
2. Do you have a personal technology plan or vision for your students concerning computer-based technology? 21st century skills? Do you feel this innovation is necessary for our students’ future?
3. What technology do you have in your classroom provided by the 21st Century project? Give me some examples of how you use each of these technologies.
4. Is the 21st century technology an element used in the preparation of lesson plans and other instructional materials?
5. How have your students used the technology provided by the 21st Century project in your classroom?
6. Can you remember a classroom-teaching event when you were using technology where it all came together for you and the students? What was happening? What did you feel like? How did the students respond? How did you respond?
7. How has your teaching changed as a result of access to emerging technology?
8. Can you describe how using emerging technology has changed how you view teaching?
9. Can you describe how access to emerging technology influenced how you interact with students?
10. Whom or what has influenced you to inject computer-based technology in your efforts to improve learners’ academic performance? Have you adopted a personal belief that using the technology from the project is beneficial to teaching and learning?
11. How have you collaborated with your peers since implementation of the 21st Century project? Give some examples. Do you feel this collaboration has been beneficial in helping you integrate technology?
12. Do you perceive computer technology as a valuable resource to promote learning? Why? Why not?

13. How has the staff development provided with the 21st Century project changed your teaching method? Do you feel more of a part of a learning community? Has the collaboration with your peers made it easier to use technology in your classroom?

14. How did you see your role as a teacher before the 21st Century project training? How do you see your role as a teacher after the training? What changes have you encountered?

15. What is your vision for the use of computer-based technology in the future? Do you think your fellow participants share this vision? Have you felt empowered by the project, and do you feel a sense of ownership in its success or failure?

16. What dreams do you hold for the students you teach as they relate to applying technology to their learning?
APPENDIX B

TEACHER CONSENT FORM

(Date)

Congratulations!!

Your classroom has been chosen to become a model 21st Century classroom as a part of the 21st Century project that has begun in conjunction with (System Name) and (System Name). We are very excited about this opportunity and feel that you will be as well. Your classroom will become a showcase for technology in our school system with the addition of an LCD projector, an Interwrite School Pad, a set of Classroom Response units, a dedicated teacher computer, an Elmo document camera, an integrated sound system with teacher microphone, and a DVD/VCR combo.

As you might imagine, there is training involved with the receipt of this equipment. This training will encompass the use of the equipment as well as the effective integration of technology into your current curriculum. Equipment training is tentatively scheduled for (date) in (location) and curriculum training will be held in (location) on (date). The curriculum training will require an overnight stay and the grant will pay for your expenses. If you do not attend the training, you will not receive the equipment as we feel that its effective use hinges on effective training.

Please indicate below if you will be able to attend the scheduled training and if you are ready to embark on an exciting journey in technology. For planning purposes, I must have all responses by (date). You may fax your responses to (number). If I do not hear from you by that date, I will assume that you are not interested.

Thanks for all you do,

Technology Coordinator

_____ Yes, I would like to become a pioneer in the 21st Century Project and receive 21st Century classroom equipment. I understand that this involves mandatory training that I agree to attend.
    _____ I will be staying overnight at (location) on (date).
    _____ I will be commuting and not need a room on the (date).

_____ I decline the invitation to become a pioneer in the 21st Century Project and understand that I will receive no equipment as a result of my decision.

_____________________________________
Signature and Date
APPENDIX C

IRB APPROVAL

August 17, 2009

Kimberly Moody
Department of ELPTS
College of Education
Box 870362

Re: IRB#: 09-OR-233, Teacher Perceptions of Moving Toward Technology Innovation: Does An Enhancing Education Through Technology Grant Lead to Innovation and Change?

Dear Kimberly Moody:

The University of Alabama Institutional Review Board has granted approval for your proposed research

Your application has been given expedited approval according to 45 CFR part 46. Approval has been given under expedited review category 7 as outlined below:

(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, or history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies

Your application will expire on August 13, 2010. If your research will continue beyond this date, complete the relevant portions of Continuing Review and Closure Form. If you wish to modify the application, complete the Modification of an Approved Protocol. Changes in this study cannot be initiated without IRB approval, except when necessary to eliminate apparent immediate hazards to participants. When the study closes, complete the appropriate portions of the Continuing Review and Closure Form.

Please use reproductions of the IRB approved stamped consent form to obtain consent from your participants.

Should you need to submit any further correspondence regarding this proposal, please include the above application number.

Good luck with your research.

Sincerely,

Carrollato I. Myles, MSM, CMM
Director & Research Conformance Officer
Office of Research Compliance
The University of Alabama
APPENDIX D

CONSENT FORMS

UNIVERSITY OF ALABAMA
Informed Consent for a Research Study

You are being asked to take part in a research study. This study is called Teacher Perceptions of Moving Toward Technology Innovation: Does an Enhancing Education Through Technology Grant Lead to Innovation and Change?

The study is being conducted by Kimberly Moody, who is a doctoral student, at The University of Alabama as part of the requirements for my degree.

Kimberly Moody is being supervised by Dr. Margaret L. Rice, who is an Associate Professor and Program Coordinator of Computers and Applied Technology at The University of Alabama.

What is this study about?

The purpose of this study is to explore the beliefs and perceptions of participants in the Project funded by an Enhancing Education Through Technology (EETT) grant for technology integration, concentrating on factors that reveal how the implementation of the 21st century hardware and staff development might have changed the atmosphere of their classrooms and teaching practices.

Why is this study important—What good will the results do?

Findings from this study are important because the No Child Left Behind Act (NCLB) of 2002 calls for the increase in accountability tied to standardized testing, greater flexibility for schools, more choices for parents and students, and using research to guide instruction (U. S. Department of Education, 2002). The Enhancing Education Through Technology program (Title II, Part D, of the Elementary and Secondary Education Act) is the U.S. Department of Education’s only program dedicated to the integration of educational technology in K-12 schools. EETT explicitly supports the broad goals of the Elementary and Secondary Education Act (ESEA) through the use of technology in schools. The primary goal of the program is to improve student academic achievement in elementary and secondary schools through the use of educational technology. The findings from this study will provide evidence of how the EETT funding is being used to affect change in the classroom.

Why have I been asked to take part in this study?

You have been asked to be in this study because you are a K-12 public school teacher involved in the Project, and can provide valuable information regarding the implementation of 21st century technology in the classroom.

How many people besides me will be in this study?

Two teachers from each county involved in the Project, and the three technology coordinators of each district will be asked to participate in this study. The sample size of the classrooms in each district is 16 classrooms across the three districts for a total of 48 classrooms.

What will I be asked to do in this study?

If you decide to be in this study, you will be asked to do the following:

Participate in an interview regarding your perceptions of how the 21st century technology might have changed your classroom learning environment. You will also be asked to complete the primary...
researcher to observe the use of the technology in your classroom. You will also be asked to provide your name and contact information, which will be kept highly confidential.

How much time will I spend being in this study?

If you agree to participate in an interview, the interview will require about 90 minutes of your time. The classroom observations will take up approximately 60 more minutes of your time.

Will I be paid for being in this study?

No

Will being in this study cost me anything?

There will be no cost to you except for your time in completing the interview and allowing for the researcher to observe your classroom use of technology.

Can the researcher take me out of this study?

The researcher may take you out of this study if you state you do not want to complete the interview or allow the researcher to come into your classroom for observation.

What are the benefits (good things) that may happen to me if I am in this study?

Although benefits cannot be promised in research, it is possible/likely that you will learn more about technology integration and 21st century technology.

What are the benefits to scientists or society?

This study will seek to explain teachers’ acceptance of technology integration as an innovation, identify factors that teachers feel have shaped them into becoming technology integrators, and note identifiable changes in their own teaching practices. Educational reform to prepare students for the 21st century is important because today’s student will require new abilities to thrive in the future. Not surprisingly, students today expect to learn in an environment that mirrors their lives and their futures—one that seamlessly integrates today’s digital tools, accommodates a mobile lifestyle, and encourages collaboration and teamwork in physical and virtual spaces. The disconnect between a student’s digital life and school matters because students learn better when they are engaged, and research about what engages them points to technology (America’s Digital Schools 2006-A Five-Year Forecast: Mobilizing the Curriculum, 2006). The results of this study about innovation and change, and teacher perceptions regarding integration of technology will help guide districts, schools, and teachers in implementing future reform initiatives.

What are the risks (dangers or harm) to me if I am in this study?

Participation in this study does not propose any foreseeable risks to you.
How will my confidentiality (privacy) be protected? What will happen to the information the study keeps on me?

For those participants who agree to be interviewed, you, the teacher, understands that the researcher Kimberly Moody, will be the only person who will have access to the identities of each of the participants and identifying information. There is no method directly or through identifiers that a particular teacher could be identified. No one will have access to the identities of the participants at any time. The strictest of confidentiality will be maintained and access regarding the true identities of participants providing information is limited to the researcher only. An audio recording will be made of each interview to allow for transcription and interpretation by the principal investigator.

For those participants who consent to be interviewed, their records will be kept in locked files with access only allowed to the researcher. No one will be able to recognize the participants in any reports or publications that result from this study. At the completion of the research, all identifying information from the participants who agreed to be interviewed will be destroyed by a paper shredder, including interview transcripts. Any audio tapes used to record interviews for those participants who agree to be interviewed will also be destroyed.

What are the alternatives to being in this study? Do I have other choices?

You can refuse to participate in the interview or allow classroom observation.

What are my rights as a participant?

Taking part in this study is voluntary—it is your free choice. You may choose not to take part at all. If you start the study, you can stop at any time. Leaving the study will not result in any penalty or loss of any benefits you would otherwise receive.

Who do I call if I have questions or problems?

If you have questions about the study right now, please ask them. If you have questions about the study later on, please call the investigator, Kimberly Moody at 256-565-3046 or kim.moody@dcs.edu or my advisor, Dr. Margaret L Rice, who is Associate Professor and Program Coordinator of Computers and Applied Technology at The University of Alabama at 334-348-1165 or mrice@bamaed.ua.edu. If you have any questions about your rights as a research participant you may contact Ms. Tanta Myles, The University of Alabama Research Compliance Officer, at (205)-348-5152.

I have read this consent form. The study has been explained to me. I understand what I will be asked to do. I freely agree to take part in it. I will receive a copy of this consent form to keep.

_____________________________ ________________
Signature of Research Participant Date

_____________________________ ________________
Investigator Date

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EXPIRATION DATE: 12/31/10

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UNIVERSITY OF ALABAMA
Informed Consent for a Research Study

You are being asked to take part in a research study. This study is called Teacher Perceptions of Moving Toward Technology Innovation: Does an Enhancing Education Through Technology Grant Lead to Innovation and Change?

The study is being conducted by Kimberly Moody, who is a doctoral student, at The University of Alabama as part of the requirements for my degree.

Kimberly Moody is being supervised by Dr. Margaret L. Rice, who is an Associate Professor and Program Coordinator of Computers and Applied Technology at The University of Alabama.

What is this study about?

The purpose of this study is to explore the beliefs and perceptions of participants in the Project funded by an Enhancing Education Through Technology (EETT) grant for technology integration, concentrating on factors that reveal how the implementation of the 21st century hardware and staff development might have changed the atmosphere of their classrooms and teaching practices.

Why is this study important--What good will the results do?

Findings from this study are important because the No Child Left Behind Act (NCLB) of 2002 calls for the increase in accountability tied to standardized testing, greater flexibility for schools, more choices for parents and students, and using research to guide instruction (U. S. Department of Education, 2002). The Enhancing Education Through Technology program (Title II, Part D. of the Elementary and Secondary Education Act) is the U.S. Department of Education’s only program dedicated to the integration of educational technology in K-12 schools. EETT explicitly supports the broad goals of the Elementary and Secondary Education Act (ESEA) through the use of technology in schools. The primary goal of the program is to improve student academic achievement in elementary and secondary schools through the use of educational technology. The findings from this study will provide evidence of how the EETT funding is being used to affect change in the classroom.

Why have I been asked to take part in this study?

You have been asked to be in this study because you are a Technology Coordinator involved in the Project, and can provide valuable information regarding the implementation of 21st century technology in the classroom.

How many people besides me will be in this study?

Two teachers from each county involved in the Project, and the three technology coordinators of each district will be asked to participate in this study. The sample size of the classrooms in each district is 16 classrooms across the three districts for a total of 48 classrooms.

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EXPIRATION DATE: 8/12/2010

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What will I be asked to do in this study?

If you decide to be in this study, you will be asked to do the following:

Participate in an interview regarding your perceptions of how the 21st century technology might have changed the learning environment in the __________ classrooms. You will be asked to suggest two teachers from your district (one elementary and one middle/high school teacher for the primary investigator to interview). You will also be asked to provide your name and contact information, which will be kept highly confidential.

How much time will I spend being in this study?

If you agree to participate in an interview, the interview will require about 90 minutes of your time.

Will I be paid for being in this study?

No

Will being in this study cost me anything?

There will be no cost to you except for your time in completing the interview and suggesting two teachers from your district to be interviewed by the principal investigator.

Can the researcher take me out of this study?

The researcher may take you out of this study if you state you do not want to complete the interview.

What are the benefits (good things) that may happen to me if I am in this study?

Although benefits cannot be promised in research, it is possible/likely that you will learn more about technology integration and 21st century technology.

What are the benefits to scientists or society?

This study will seek to explain teachers’ acceptance of technology integration as an innovation, identify factors that teachers feel have shaped them into becoming technology integrators, and note identifiable changes in their own teaching practices. Educational reform to prepare students for the 21st century is important because today’s student will require new abilities to thrive in the future. Not surprisingly, students today expect to learn in an environment that mirrors their lives and their futures—one that seamlessly integrates today’s digital tools, accommodates a mobile lifestyle, and encourages collaboration and teamwork in physical and virtual spaces. The disconnect between a student’s digital life and school matters because students learn better when they are engaged, and research about what engages them points to technology (America’s Digital Schools 2006-A Five-Year Forecast: Mobilizing the Curriculum, 2006). The results of this study about innovation and change, and teacher perceptions regarding integration of technology will help guide districts, schools, and teachers in implementing future reform initiatives.

What are the risks (dangers or harm) to me if I am in this study?

Participation in this study does not propose any foreseeable risks to you.
How will my confidentiality (privacy) be protected? What will happen to the information the study keeps on me?

For those participants who agree to be interviewed, you, the technology coordinator, understands that the researcher Kimberly Moody, will be the only person who will have access to the identities of each of the participants and identifying information. There is no method directly or through identifiers that a particular teacher could be identified. No one will have access to the identities of the participants at any time. The strictest of confidentiality will be maintained and access regarding the true identities of participants providing information is limited to the researcher only. An audio recording will be made of each interview to allow for transcription and interpretation by the principal investigator.

For those participants who consent to be interviewed, their records will be kept in locked files with access only allowed to the researcher. No one will be able to recognize the participants in any reports or publications that result from this study. At the completion of the research, all identifying information from the participants who agreed to be interviewed will be destroyed by a paper shredder, including interview transcripts. Any audio tapes used to record interviews for those participants who agree to be interviewed will also be destroyed.

What are the alternatives to being in this study? Do I have other choices?

You can refuse to participate in the interview or allow classroom observation.

What are my rights as a participant?

Taking part in this study is voluntary—it is your free choice. You may choose not to take part at all. If you start the study, you can stop at any time. Leaving the study will not result in any penalty or loss of any benefits you would otherwise receive.

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Signature of Research Participant

Date

Investigator

Date

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