ABSTRACT

SOORMA, JYOTI. Teacher Concerns and Attitudes During the Adoption Phase of One-to-One Computing in Early College High Schools. (Under the direction of Dr. Ellen S. Vasu, Dr. Kevin M. Oliver, Dr. Tuere A. Bowles.)

Ubiquitous computing has opened new opportunities for teaching and learning, and is transforming school learning environments. The popularity of one-to-one computing has been increasing rapidly, with more and more schools adopting this initiative. However, studies on past one-to-one initiatives have raised concerns over the proper adoption of technology into classrooms. To ensure successful implementation of a change generating initiative like one-to-one computing, schools should ensure buy-in and readiness of the stakeholders, especially the teachers. Understanding the teacher's beliefs and attitudes towards technology, and addressing the teacher concerns is a critical step in ensuring the successful implementation of technology integration.

The purpose of this basic qualitative study is to understand the beliefs, attitudes, and concerns of Early College High School teachers towards one-to-one computing, and the support the teachers need during the early adoption phase of the one-to-one computing initiative. The study was guided by the following research questions: What prior experiences do the teachers bring to one-to-one computing? What are the teachers' beliefs, attitudes, and concerns towards one-to one computing? What support do the teachers need during the adoption phase of the computing initiative? Data were collected using semi-structured interviews and a focus group, and data were analyzed using the constant comparative method. The data analysis revealed that while teachers had a positive attitude towards the one-to-one computing initiative and its impact on students, the pedagogical beliefs differed

among them. Also, a number of teacher concerns surfaced related to hardware and software support, professional development, classroom management, communication, and personal anxieties.

Some of the major implications for practice identified are: need for developing a communication plan; restructuring of professional development to meet core curriculum technology standards and teacher-specific concerns; and on-going evaluative research to provide formative feedback during all phases of the implementation with respect to the goals of the one-to-to-one computing initiative for the schools.

Teacher Concerns and Attitudes During the Adoption Phase of One-to-One Computing in Early College High Schools

by
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DEDICATION

To my wonderful parents, in-laws, and my loving husband

BIOGRAPHY

Jyoti Soorma, the daughter of Prem Inder Soorma and Pramod Soorma was born in New Delhi, India. Her mother is a school teacher, and father is a retired Army officer. She completed her Bachelors of Arts in 1998 from Delhi University, and then went on to do her Masters in Business Administration (in Human Resources) from Symbiosis Institute of Management Studies, Pune, India. After completing her MBA, she worked for four years in Human Resources for companies like Tata Finance Ltd. and Kodak.

She got married in 2004, and there after joined her husband, Vivek Grover in Raleigh, North Carolina. She joined the program of Masters in Instructional Technology at North Carolina State University in Spring 2006. With the defense of this thesis, she is receiving the Master of Science in Instructional Technology degree.

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CHAPTER 1

INTRODUCTION

Modern technologies such as laptops, the Internet, and sophisticated computer based software present new opportunities for teaching and learning (Brill & Galloway, 2007; Boling, 2003; Poland, la Velle & Nichol, 2003; Resnick, 1995, 1998). Early research has shown that providing students with ubiquitous access to wirelessly connected computers has the potential to transform learning environments and improve student-learning outcomes (Roschelle, Penuel, & Abrahamson, 2004). Although much of the research on laptop programs is still ongoing, current evidence and findings from laptop program evaluations report several positive outcomes. These outcomes include increased student engagement (Russell, Bebell, Cowan & Corbelli, 2003; MEPRI, 2003; Rockman et al., 1998), decreased disciplinary problems (Baldwin, 1999, MEPRI, 2003), increased use of computers for writing, analysis and research (Cromwell, 1999; Baldwin, 1999; Guignon, 1998; Russell, Bebell, & Higgins, 2004), a movement toward student-centered classrooms (Rockman et al., 1998), and teachers' perceived increase in students' academic performance (GMSP, 2004). Some studies have also reported that students increased their organizational skills with laptop computers (Lowther et al., 2001; Zucker & McGhee, 2005).

More than a thousand schools nationwide have committed themselves to laptop computing initiatives, and the number is increasing rapidly (Penuel, 2005). A growing number of states are purchasing laptop computers for all students and teachers. In the United States, school districts reportedly spent $7.87 billion on technology equipment during the 2003–2004 school year (Quality Education Data, 2004). With this rapid increase in the

implementation of laptop programs, school boards and policy-makers are evaluating the impact on teaching and student learning. Though different schools may implement one-to-one learning for various reasons, the fundamental aim is improving student achievement, advancing digital equity, enhancing teaching and learning, strengthening economic development (Penuel, 2005).

The earliest one-to-one initiatives in the U.S. began appearing in the mid-1990s, and the most visible sponsored initiative at that time was Microsoft's Anytime, Anywhere Learning program (Rockman et al, 1998). Maine has sponsored the largest laptop initiative providing computers and wireless Internet access to all students in seventh and eight grades. Students and teachers in Maine reported positive impacts on student engagement and learning (Polster, 2003). Indiana, Michigan, New Hampshire, New Mexico, Texas, and Vermont are also experimenting with state-supported laptop initiatives, as are many individual school districts throughout the United States, including Henrico County, Virginia, the largest district-funded laptop program in the United States (Bonifaz & Zucker, 2004). Early research as well as the limited, yet positive evaluations of these past one-to-one programs as those in Maine and Henrico County, suggests that one-to-one computing is well worth considering.

A recent one-to-one laptop program has been initiated In North Carolina. This one-to-one initiative targets seven of North Carolina's Early College High Schools. The Early College High Schools are part of the "New Schools Project" that attempt to make higher education more accessible by creating a new model of high school on community college campuses. Students earn a high school diploma and an associate's degree from community

college or two years of university credit toward a four-year degree by the time they graduate from high school. The one-to-one initiative in North Carolina Early College High Schools has been initiated with an aim to make North Carolina competitive in the global marketplace, and to help its schools to utilize the latest technology tools and methods for 21st-century teaching and learning (New Schools Project, 2008). This initiative aims to do more than just putting technology in the classroom; it aims to help students achieve success in a global world with a curriculum designed to meet the needs of future-ready students (NC 1:1 Learning Collaborative, 2008).

Despite continued interest in and excitement about one-to-one computing, few research studies fully address the impacts on teaching and learning in these intensive computing environments (Bebell, 2005). Various examples in the past have shown that while technology is being made available to schools, a critical issue is emerging about how technology is or is not being used in the teaching and learning process. This becomes important because student achievement may be compromised by poor technology integration practices. Ertmer, Addison, Lane, Ross, and Woods (1999, p. 54) also stated, "Despite the fact that the number of computers in teachers' classrooms has increased dramatically in the last twenty years, researchers and educators alike report that integrating technology into classroom curricula is not easily accomplished." Further, in spite of vast investments made on ubiquitous computing in schools, students are not being provided with whole, dynamic learning experiences, but rather with limited, arbitrary activities. Examples in the past have shown that majority of computer use across subject areas where computer skills are not the

direct goal, remain ‘skill and practice’ software, or traditional computer-sided instruction (Becker, 2000).

Many reasons have been offered as an explanation for the low levels of technology integration in classrooms. Handal (2004) proposed two factors, which are the lack of teachers’ supporting beliefs and traditional teaching practices. Handal stated that significant number of teachers do not support the principle that technology is a powerful tool for teaching and learning, and that teachers’ instructional beliefs act as a filter through which teachers make instructional decisions in class rather than relying on their own pedagogical knowledge or curriculum guidelines. Cuban (1993, p.53) suggested, “the knowledge, beliefs, and attitudes that teachers have shaped what they choose to do in their classrooms and explain the core of instructional practices that have endured over time” (p. 256). Also, teachers’ beliefs and practices evolve along a continuum of technology integration that gradually leads to increasingly effective instructional practices (Dwyer, Ringstaff, and Sandholtz, 1991), and the movement from the entry phase to invention (technology-intensive environments) requires time and ongoing support. It is very improbable that teachers can amend their own instructional practice if their beliefs on teaching and learning remain unexamined. Therefore, teachers’ instructional beliefs need to be confronted and re-appraised in terms of their beliefs and principles underpinning an innovation; otherwise, changes will be only cosmetic of the original innovation goals, as has happened in the past with a large number of large-scale innovations (Burkhardt, Fraser, & Ridgway, 1990).

Other studies have shown that if technology integration is to be successful, teachers must be comfortable with technology tools, be prepared to integrate technology effectively

into the classroom curriculum, and be able to incorporate the new teaching methods enabled by technology (CEO Forum, 2000; U.S. Department of Education, 2000). Moreover, it has been seen that teachers are motivated to use technology when they have a clear understanding of how it will improve their teaching and students' learning (Albion & Ertmer, 2002).

Ertmer, Addison, Lane, Ross, and Woods (1999), carried out a study to examine barriers to technology implementation. The authors concluded that there are two barriers: first order barriers (external) and second order barriers (internal). The first order barriers include concerns about hardware and software, administrative support, and insufficient time to prepare instructional tasks. The second order barriers refer to teacher's beliefs and attitudes towards implementation of technology in education. Further, Hall & Hord (1987) postulated that individual teachers have different kinds of concerns about their involvement with a curriculum at different times. According to Hall's model, teacher's concerns about an innovation progress through different Stages of Concern (SoC), and a teacher may experience several "stages of concern" concurrently, but there are differential degrees of intensity. Moreover, research on one-to-one laptop programs have indicated that the reason many of the professional development programs are found to be irrelevant is because they are not targeted toward teachers' specific "stages of concern" (Loucks & Hall, 1977). Understanding the concerns of teachers thus helps schools to determine direction for professional development, and design interventions for effective innovation, adoption, and implementation of a laptop program.

Teachers are thus crucial to implementing technology integration and new methods of teaching. Without teacher buy-in, the learning environment does not change (Hewlett Packard, Intel Corporation, Microsoft, 2005). It is therefore imperative that teacher' beliefs, attitudes, and concerns are gauged to understand their preparedness before implementing the one-to-one initiative. The schools therefore cannot afford to undervalue the teacher's beliefs and concerns; rather, there is a pressing need to examine the interacting factors of teachers' beliefs about computing, how these beliefs are shaped, and in turn, influence technology-integration practices in the context of actual classroom activities.

Theoretical Framework

The concerns based adoption model (CBAM) provides a theoretical framework for understanding the beliefs, attitudes, and concerns of teachers during the implementation phase of one-to-one computing. The Concerns Based Adoption Model (Hall, George, & Rutherford, 1979; Hall & Hord, 1987, 2001) is a participant-based change model that has been widely accepted in educational research, especially in studying the adoption of educational innovations. CBAM is an appropriate model for gauging the technological change for teachers as it maintains a participant-based focus on understanding an individual's attitudes, perceptions, thoughts, and considerations toward using a new innovation (Adams, 2002; Ansah & Johnson, 2003; Casey, 2000; Casey, Harris & Rakes, 2004; Dobbs, 2004; Gershner & Snider, 2001; Gwele, 1997; Lienert, Sherrill, & Myers, 2001; Newhouse, 2001; Signer, Hall & Upton, 2000; Todd, 1993).

The central underlying assumption of CBAM is that any change process involves people, and an organization cannot change until the individuals within it change (Hall &

Hord, 1987, 2001). Acknowledging concerns and providing appropriate support can help resolve concerns and facilitate change. By alleviating the concerns of one stage or phase, educators can motivate individuals to move to a higher level of implementation, whereas by discounting the concerns of teachers, one may only intensify their concerns. Further, the reason many of the professional development programs are found to be irrelevant are because they are not targeted toward their specific "Stages of Concern" (Loucks & Hall, 1977). Understanding the concerns of teachers thus helps schools to determine direction for professional development, and design interventions for effective innovation, adoption, and implementation. It also provides information for planning support services. The generative aspect of the CBAM promotes the facilitation of change through the recognition and validation of teachers' concerns about technology integration. CBAM thus asserts that concerns are legitimate, and personalized interventions will help reduce the obstacles in a change process.

Individual teachers will have differing thoughts, feelings, attitudes, and perceptions, framed as "concerns" by Hall and Hord (1987, 2001) about the adoption of technology in classrooms. Thus, it is useful for administrators and educators in the Early College High Schools to have a picture of teachers' concerns, both before and during the implementation phase of an innovation (Fullan, 1999). In the Early College High Schools, understanding the attitudes, beliefs, and concerns of teachers during the adoption process of the one-to-one laptop program, can help inform appropriate professional development initiatives to support and sustain the educational initiative. Also for this study, the CBAM model, with its focus on "self", "task," and "impact" concerns has informed the interview guide that will be used for

interviewing teachers to understand what their beliefs, attitudes, and concerns about one-to-one computing are at various levels.

Problem Statement

Research has not kept up with the rapid expansion of the one-to-one initiatives or with their breadth (Penuel, 2005). In spite of the growing popularity of one-to-one computing, studies have suggested that technology has not been adequately adopted in schools (Maddux, LaMont Johnson, & Willis, 1997; Mann, 2000; Newhouse, 1998). Though previous studies have also shown consistently that teachers need time to become comfortable with the machines (Sandholtz, Ringstaff, & Dwyer, 1997, Shiengold & Hadley, 1990), little scholarly literature is available that examines the impacts on teaching and learning in these intensive computing environments (Schacter, 1999; Russell, Bebell, & Higgins, 2004). Much of the available research on laptop computing are quantitative studies about topics like hardware access and management, professional development for teachers, and impact on students. Few researchers have carried out a study on the teachers, who are the main change agents, to understand how they experience a laptop computing initiative. Recent large-scale survey research on factors relating to computer and Internet use have shed light on important trends (Becker, 2000), but studies utilizing interpretive methods are needed to understand the process of change. Though there have been studies that revealed teacher beliefs about teaching and learning both affect initial levels of adoption and evolve when they begin to use computers (Collins, 1991; Cuban, 1986, 2001; Dwyer, Ringstaff, & Sandwltz, 1991), findings are not conclusive on how these processes take place and how teachers feel during the times of transition (Burns & Polman, 2006). Also, the existing literature on technology

integration shows that teachers need assistance in learning to use computers as tools for teaching (Schwab & Foa, 2001), and that sustained group professional development can improve chances for meaningful and lasting integration (Blumenfeld et al., 1991), but the ideal level of training for different purposes and contexts remain elusive (Burns & Polman, 2006). Thus, there is a need for a qualitative study to understand in detail how teachers experience the adoption of a one-to-one computing initiative, and the factors (beliefs, attitudes, and concerns) that may impact the successful implementation of the computing program.

Purpose of the Study

The purpose of this study is to understand the beliefs, attitudes, and concerns of teachers in Early College High Schools towards one-to-one computing, and the use of computers in classrooms during the adoption phase of the one-to-one computing initiative. The study will provide the opportunity to thoroughly investigate the phenomena of teachers' adoption of technology, particularly in the Early College High School environment, and describe what actually takes place, from the teachers' descriptions of their personal experiences of integrating technology into their classroom.

The main research questions that guide the study are:

1. What prior experiences do the teachers bring to one-to-one computing?
2. What are the teachers' beliefs, attitudes, and concerns towards one-to one computing?
3. What support do the teachers need during the adoption phase of the computing initiative?

Significance of the Study

By collecting qualitative data from teachers about how they perceive technology, and their concerns regarding implementation of technology in classrooms, it is intended that this data may be utilized by decision-makers for the purpose of better evaluating their school laptop programs. The findings of this research would also be useful for professional development that will take into consideration the factors that influence teacher beliefs, attitudes, and concerns, and also the coping strategies for the same. The data could be used to inform planning and implementation of teacher training, and support initiatives, and also be used as baseline data for future professional development endeavors of Early College High School. Also, a qualitative methodology emphasizes the value of individual experiences and views, as encountered in real-life situations. This type of investigation is useful in educational initiatives, as many issues concern the quality of the lived experience of individuals, which cannot be reduced to numerical values using statistical analysis.

Limitations

The adoption of an innovation takes time, and this study, which focuses only on the initial three months of the implementation phase of one-to-one computing, is insufficient to observe the entire adoption process. A longitudinal study would be required to study the adoption process in detail, and to provide formative feedback to the authorities regarding the impact of the program. However, this study can serve as a valuable baseline for technology integration endeavors including teacher technology professional development and continued adoption measurement.

Key Terms Defined

One-to-One Computing

By definition, one-to-one learning involves one student, one computer, one interactive, personalized learning experience in a wireless environment with anytime access to the Internet. The students have access to computers 24/7 (24 hours per day, 7 days per week), anytime anywhere.

Penuel (2006) came up with three core features common to a wide variety of initiatives as defining characteristics of one-to-one computing in the classroom: (1) providing students with use of portable laptop computers loaded with contemporary productivity software (e.g., word processing tools and spreadsheet tools), (2) enabling students to access the Internet through schools' wireless networks, and (3) a focus on using laptops to help complete academic tasks such as homework assignments, tests, and presentations.

Early College High Schools

In this study, Early College High Schools are the schools modeled on the work of the "New Schools Project" where a small high school is co-located on a community college campus with students taking both traditional high school and community college courses. In the Early College High Schools, students earn a high school diploma and an associate's degree from community college or two years of university credit toward a four-year degree by the time they graduate from high school. Early College High Schools aim to provide a new model of high school that will boost graduation rates, boost college-going rates, and boost the preparedness of our students to work in an economy that demands knowledge, talent, and skills (Office of the Governor, State of North Carolina, 2004).

Beliefs

Beliefs are "psychologically held understandings, premises or propositions about the world that are felt to be true" (Richardson, 1996, p. 103). Calderhead (1996), and Richardson (1996) define belief as premises or suppositions about something that are felt to be true. Specifically, teachers' beliefs may include their educational beliefs about teaching and learning (i.e., pedagogical beliefs), and their beliefs about technology (Ertmer, 2005; Windschitl & Sahl, 2002). Beliefs are mainly cognitive and are typically expressed with the phrase "I believe." In this study, teachers may have their own definitions of beliefs, which will be incorporated, acknowledging that there may be a wide diversity of understandings of the construct.

Attitudes

According to Simpson, Koballa, Oliver, and Crawley (1994), attitudes can be defined as specific feelings that indicate whether a person likes or dislikes something. In the context of technology integration, teacher attitudes toward technology may be conceptualized as teachers liking or disliking the use of technology.

Concerns

Concerns can be described as the feelings, thoughts, and reactions individuals develop in regard to a new program or innovation that is relevant to their daily job (Hord et al., 1998).

Professional Development

For the purposes of this study, professional development includes all activities that promote growth in the participant. The focus is on the professional development of teachers

in the area of technology and comprises workshops, training, peer mentoring, coaching, and collegial sharing.

CHAPTER 2

REVIEW OF LITERATURE

An important step in the research process is to review the thinking and research relevant to the topic at hand. The task of locating, reading, synthesizing, and writing a review of the literature provides the researcher with a foundation from which to explore further (Merriam, 1998). According to Merriam (1998, p.49), the purpose of a literature review conducted prior to a research study is to:

> Provide a foundation for building knowledge. No research problem in the social sciences exists alone as an area of human endeavor. There is always some related literature, and it is this literature that is reviewed to form the "pedigree" of the problem. In order to add to knowledge in a field, you must have a thorough understanding of the major theoretical points of view and the major research investigations relevant to the topic.

The literature contributing to current knowledge regarding teacher beliefs, attitudes, and concerns towards one-to-one computing initiatives is multifaceted in nature. This chapter will look at current literature with respect to teacher beliefs, attitudes, and concerns towards teaching and learning with technology in one-to-one computing initiatives. This chapter will also review findings from past one-to-one laptop initiatives like The Maine Learning Technology Initiative, Technology Immersion Pilot (TIP) in Texas public schools, The Berkshire Wireless Learning Initiative (BWLI), and the study conducted by Penuel (2006) and his team for Apple Computer Inc., which was a synthesis of all research studies published between 2001 and 2005, to glean lessons from implementation studies about how

one-to-one initiatives unfold under different kinds of circumstances. The theoretical framework of this study is based on the Concerns Based Adoption Model (Hall, George, & Rutherford, 1979; Hall & Hord, 1987, 2001), which focuses on the process of change experienced by teachers attempting to implement new curriculum materials and instructional practices (Anderson, 1997). The literature review is organized into four main sections: Teacher Concerns and the Concerns Based Adoption Model, Teacher Attitudes, Teacher Beliefs, and the Barriers to Technology Integration.

Teacher Concerns and the Concerns Based Adoption Model (CBAM)

Concerns can be described as the feelings, thoughts, and reactions individuals develop in regard to a new program or innovation that is relevant to their daily job (Hord et al., 1998). The study of concerns has attracted a great deal of interest in recent decades as a result of the presumed link between the successful implementation of educational change and reform, and the level and type of individual concerns. Concerns exert a powerful influence on the implementation of reforms and determine the type of assistance that teachers may need in the adoption process.

The concept of concerns, and the associated theoretical framework, dates back to the pioneering work of Fuller. Fuller (1969) put forward a classification of teachers' concerns consisting of four developmental stages; namely, "Awareness", "Self", "Task", and "Impact" concerns. "Awareness-stage" describes a person who either isn't aware of the change being proposed or doesn't want to learn about it. "Self" concerns relate to the teachers' own worries about their ability to perform in the school environment, while "Task" stage is linked to concerns regarding the daily teaching duties, especially in relation to constraints such as

the large number of students in the class and the lack of resources. Finally, "Impact" concerns refer to the teachers' apprehension concerning student outcomes, Fuller's framework has provided the basis for subsequent studies of the nature of teacher concerns, some of which have focused on concerns regarding the adoption of educational innovations and reforms.

The concerns based adoption model (CBAM), which is a change and diffusion model provides the theoretical framework for understanding the beliefs, attitudes, and concerns of teachers during the implementation phase of one-to-one computing in this study. The Concerns Based Adoption Model (Hall, George, & Rutherford, 1979; Hall & Hord, 1987, 2001) is a participant-based change model that has been widely accepted in educational research, especially in studying the adoption of technology innovations. CBAM seems an appropriate model for gauging the technological change for teachers as it maintains a participant-based focus on understanding an individual's attitudes, perceptions, thoughts, and considerations toward using a new innovation (Adams, 2002; Ansah & Johnson, 2003; Casey, 2000; Casey, Harris & Rakes, 2004; Dobbs, 2004; Gershner & Snider, 2001; Gwele, 1997; Lienert, Sherrill, & Myers, 2001; Newhouse, 2001; Signer, Hall & Upton, 2000; Todd, 1993).

The model was initially framed via observations of K-12 educators and college professors as they adopted and implemented educational innovations (Hall & Hord, 1987). The CBAM model has been described as a comprehensive tool to address changes in educational settings, as well as for its inclusive perspective that pays attention to the individuals and the organization that are involved in the change process (Sashkin &

Ergermeier, 1992). The central underlying assumption of CBAM asserts that an important factor in any change process is the people involved, as an organization cannot change until the individuals within it change (Hall & Hord, 1987, 2001). The CBAM model recognizes that concerns are critical to the understanding of personal change, and therefore the importance of the individual in change by assessing the concerns profile of an individual. Acknowledging concerns and providing appropriate support can help resolve concerns and facilitate change. By alleviating the concerns of one stage or phase, educators can motivate individuals to move to a higher level of implementation, where as by discounting the concerns of teachers, one may only intensify their concerns. The generative aspect of the CBAM is intended to promote the facilitation of change through the recognition and validation of teacher's concerns about the educational innovation. Conceptually, this model asserts that concerns are legitimate, and that personalized interventions will help reduce the obstacles in a change process. The CBAM model is based on the following assumptions about change (Hall & Hord, 2001):

1. Change is a process and not an event.
2. There are significant differences in what is entailed in development and implementation of an innovation.
3. An organization does not change until the individuals within it change.
4. Innovations come in different sizes. Innovations can be products or processes, and can be single innovations or more.
5. Interventions are the actions and events that are key to the success of the change process.

6. Although both a top-down and bottom-up change can work, a horizontal perspective is best.

7. Administrator leadership is essential to long-term change success.

8. Mandates can work.

9. The school is the primary unit of change.

10. Facilitating change is a team effort.

11. Appropriate interventions reduce the challenges of change.

12. The context of the school influences the process of change.

The CBAM includes three key tools used to collect relevant data: Stages of Concerns (SoC), Levels of Use (LoU), and Innovation Configurations (IC). The most important tool in the model is the SoC questionnaire, which is used to measure teachers' concerns about an innovation they are expected to implement (Hall and Hord, 2001). The Stages of Concern (SoC) describes "how teachers or others perceive an innovation and how they feel about it" (Hall & Hord, 1987, p. 13). The Levels of Use (LoU) identify "what a teacher is doing or not doing in relation to the innovation" (Hall & Hord, 1987, p. 13). It is the sequence that users pass through as they gain in confidence and skill in using an innovation resulting in higher levels of use from non-use to institutionalization. The Innovation Configuration (IC) "focuses on describing the operational forms an innovation can take" (Hall & Hord, 1987, p. 14). While the SoC and LoU deal generically with the change process from the social-psychological perspective of those users undergoing the change process itself in the context of the innovation, the IC circumscribes the innovation.

The Concerns-Based Adoption thus shows how the individuals most affected by change react to the implementation of these innovations (Hord et al., 1998). The CBAM is a conceptual framework for change that recognizes that people evolve in the kinds of questions that they ask and in their use of the innovation over time. This framework treats change as a process, not an event, recognizes that change is highly personal, and that innovations entail development in both feelings and skill levels. The concerns-based approach requires that change facilitators understand how their clients perceive change and then adjust what they do accordingly. The central focus of this approach is to understand clients' needs so professional development activities can respond to where clients are in the change process.

CBAM has been identified as a tool to investigate the integration of technology because of its thorough research history into educational change. Its focus on both the affective aspect (Concerns) and the behavioral (Levels of Use) provides an essential depth to the investigation. It allows the researcher to learn what is currently happening with the innovation, the integration of technology into teaching and learning, and provides some insights as to why this is so. According to Loucks-Horsley (1996), the model holds that people considering and experiencing change evolve in the kinds of questions they ask and in their use of whatever the change is. In general, early questions are more self-oriented: What is it? and How will it affect me? When these questions are resolved, questions emerge that are more task-oriented: How do I do it? How can I use these materials efficiently? How can I organize myself? and Why is it taking so much time? Finally, when self- and task concerns are largely resolved, the individual can focus on impact. For example, is this change working for students? Is there something that will work even better? The concerns model identifies

and provides ways to assess different stages of concerns, which have major implications for professional development. It points out the importance of attending to where people are and addressing the questions they are asking when they are asking them. Often, schools get to the how-to-do-it before addressing self-concerns. Schools focus on student learning even before teachers are comfortable with the materials and strategies. Thus the kinds and content of professional development opportunities can be informed by ongoing monitoring of the concerns of teachers. Also, this model suggests the importance of paying attention to implementation for several years, because it takes at least three years for early concerns to be resolved and later ones to emerge (Loucks-Horsley, 1996).

From the past one-to-one laptop programs, it has been seen that most of the teacher concerns revolved around technical problems and the lack of, or limited technical support; many teachers experienced trouble staying connected to the network, and sometimes the computers functioned slowly due to the amount of traffic online at any one time (The Maine Learning Technology Initiative, 2003). Readily available technical support is also a critical must-have for laptop programs to succeed. Teachers quoted examples like computers would "freeze" at times, forcing students and teachers to restart their computers, and causing loss of student files. A variety of other technical glitches occurred due to compatibility problems with batteries, and existing peripheral equipment (i.e., printers and projectors).

Need for support was also felt in terms of peripheral equipment and supplies that enable teachers to take full advantage of the possible uses of the laptops (The Maine Learning Technology Initiative, 2003). For example without projectors, networked printers, software, and other supportive technology, teachers are unable to successfully integrate the

laptops into their existing curriculum. Programs in which teachers report a high degree of reliability for laptops often have both within-building technical support staff devoted to helping with the program and ready access to outside vendors for major problems. For example, ensuring that all students' laptops are working makes it less likely that teachers will have to develop two sets of assignments—one for students with laptops and another for students without laptops. Being able to count on the reliability of the school's wireless network was also another critical factor, since students often use their laptops to access resources available on the web (Apple Computers, 2005)

Students have played an important role in providing the first line of technical support in several laptop programs. In Maine, for example, student "iTeams" exist in many schools to help troubleshoot routine problems with machines (Apple Computers, 2005). Teachers in Maine report that they often turn to students for help with technical problems when they arise in class. In other, smaller scale laptop programs, students play a similar role in providing technical support, both informally and formally as part of the program design.

In addition to the technical concerns, teachers reported the need for more time and professional development, which included time to explore and learn how to use the technology, and professional development activities designed to help them integrate the technology more extensively in their curriculum development and instruction. The evaluation studies confirm the value that teachers place on professional development related to the integration of technology in teaching. The MLTI report makes an observation that in the initial phase, because many teachers were in the initial stages of learning to use the technology, they were not able to make use of the technology tools in an advanced manner.

All teachers from novice to the advanced perceived the computing initiative as a challenge, and, teachers viewed the first year of adoption as only the first steps in a long process of technology integration. Teachers felt challenged to spend twice as much time outside school to research, learn, and study computer software, and particularly finding resources, which are trustworthy and easy to use. To address this concern, content specialists were assigned to help teachers in Maine, with finding digital resources and integrating technology into specific content areas. Some programs also assigned staff (either internal to the school or external) to help teachers on an as-needed basis with technology integration. Professional development was targeted to help teachers become more "student-centered" in their teaching were found especially effective in transforming instruction in laptop classrooms. A third form of professional development, informal help from colleagues within the school, was also found to have a great impact in ensuring implementation success. A number of researchers reported that they observed teachers helping each other with technology problems or engaging in joint curriculum planning, and some even reported that teachers prefer this form of professional development above others. Most teachers responded that they preferred informal training.

In the Texas Immersion Pilot (TIP), teachers at immersed campuses also received a wealth of digital resources as part of their immersion packages (Shapley et al., 2006). In the first year, most of the teachers participated in professional development aimed at increasing their familiarity with the resources, but they seldom used the new digital products. Many were overwhelmed by the complexity of learning to infuse new wireless technology into the existing curriculum, so new resources were mostly ignored. The evaluators attributed the reason to the teachers having received too many resources within a short period of time.

Similar to this, other researchers have found that projects that increase technology capacity incrementally were more successful than those that involve an intensive influx of new technology tools. Lastly, the evaluation also concluded that teachers have difficulty with instructional changes that are "too distant" from the status quo (Zhao, Pugh, Sheldon, & Byers, 2002).

Similar to MLTI and TIP, the initial evaluation of the Berkshire Wireless Learning Initiative (BWLI) also reported inequities in teachers' access to supplemental technology tools such as non-availability of LCD projectors, which was originally proposed for all BWLI seventh grade classrooms (Bebell & Russell, 2006). Teacher's responses regarding access to technology initially ranged from "somewhat difficult" to "very difficult," on an average. Teachers initially found it difficult to having all their students use computers in class. Though, after five months of 1:1 computing teachers reported the largest relative improvement for these scenarios whereby having some or all of their students use computers in class was reported to be between "somewhat easy" to "very easy." Based on the teacher results, it was seen that access to technology increased substantially for the majority of BWLI teacher respondents in the first six month, which probably resulted in increase in the number of technology products available within teachers' schools and classrooms, and also increased the percentage of teachers reporting "ease of access" to the common educational technology scenarios. Even the BWLI student surveys reported marked increases in the use of technology across the curriculum after five months of one-to-one laptop computing. Bebell & Russel (2006) pointed out a common misconception of one-to-one computing initiatives in the failure to realize the large role (in terms of both budgeting /financing and

educational philosophy) played by professional development. BWLI evaluated the teachers on one goal of the state technology plan, which was to increase the familiarity and mastery of the Massachusetts Technology Standards for both students and teachers across the state. It was seen that even after five months into the implementation, only fifty three percent of responding teachers reported familiarity with the MA PreK-12 Instructional Technology Standards. Finally, a major concern also was with teachers' perceived pressures to improve students' scores on the TAKS, making many teachers reluctant to try new and untested instructional methods and materials in the first year. Many were overwhelmed by the complexity of teaching with technology.

Teacher Attitudes

The urgency of integrating computers into the curriculum cannot be overemphasized. Many researchers have found a positive correlation between attitudes and the use of technology in the classroom. Simpson et al. (1994) define attitudes as specific feelings that indicate whether a person likes or dislikes something. In the context of this study, teacher attitudes toward technology may be conceptualized as teachers liking or disliking the use of technology. In a review of the literature on how attitudes affect the use of technology in education, Lawton and Gerschner (1982) reported that the successful use of computers in the classroom is dependent on the teachers' attitudes toward computers. Teachers' comfort, or anxiety related to computers determine teachers' positive or negative attitudes towards using computers in the classroom, therefore development of teachers' positive attitudes towards computers is considered to be a key factor in fostering computer integration and the enhancement of quality learning and teaching using computers. Teachers are change agents

in any educational initiative. Teachers are the ones to lead the schools to integrate computer technology to classrooms, and it is important for them to feel comfortable in using the technology because if they feel uncomfortable they will not use it and will not integrate it in classrooms.

Studies have shown that although teachers are equipped with knowledge and skills in using computers, the success of implementing the new curriculum with information technology in education depends greatly upon the attitudes of the teachers and their willingness to embrace such technology. Teachers are often resistant to using computer technology in the classroom; so changing teachers' attitudes is a key factor in fostering computer integration (Marcinkiewicz, 1993, 1994). As stated by Wong (2002), technical knowledge and skills is not enough, a teacher must also have the right attitudes towards technology. This is important because it has been found that teachers' attitudes toward technology have a marked influence on their readiness to utilize technology in their teaching strategies (Office of Technology Assessment, 1988).

Also, experiences with technology planning highlight the observation that teacher attitudes toward technology and technology integration seriously impact the success of professional development programs (Albion, 1999; Ross, Hogaboam-Gray, & Hannay, 1999). Thus, positive attitudes toward technology integration enhance learning to use technologies in teaching and learning; negative attitudes constrain it. This does not necessarily mean that only teachers with positive attitudes should be included in technology training activities. It does mean that negative attitudes among participants need to be valued and addressed, and that positive attitudes should be encouraged and developed. Harrison and

Rainer (1992) found that participants with negative computer attitudes were less skilled in computer use and were therefore less likely to accept and adapt to technology than those with positive attitudes. They concluded that changing individuals' negative attitudes is essential for increasing their computer skills.

While the study of teachers' attitudes is in itself important, a more significant challenge is to identify the factors that influence attitudes. There are factors that can influence teacher's attitudes towards technology. Gressard & Loyd (1985) established that perceptions of the potential usefulness of computers could influence an individual's attitudes toward computers. Loyd and Gressard (1986) showed that positive attitudes toward computers are positively correlated with teachers' experiences. With familiarity, anxieties and fears tend to decrease and confidence increases. Summers (1990) stated that one of the most common reasons for teachers' negative attitudes toward technology is the lack of knowledge and experience in this area. The amount of confidence a teacher possesses in using technology may greatly influence his/her effective implementation in the classroom. If teachers have confidence in using the technology, they will possess positive attitudes, which may greatly influence their teaching and learning process. However, if teachers are reluctant to use computers, then changing teachers' attitudes could possibly be one way of overcoming this problem. Thus, the successful use and application of computers in the educational system may very much be related to, and dependent upon, the teachers' attitudes toward instructional technology.

Evidence gathered past one-to-one initiatives during the initial year evaluations have revealed several factors that impeded progress toward immersion. For example, Texas

Technology Immersion Pilot First Year Results (2006) report that teacher readiness and receptivity were among major factors that affected technology integration. Teacher attitudes, understanding of immersion, technology knowledge and skills, and propensity toward technology use varied substantially by classroom and school. Teachers were at different stages of readiness for immersion and their receptivity varied. Varying abilities and attitudes were seen to be factors that made many teachers reluctant to try new and untested instructional methods and materials in the first year.

Whereas for the Maine Learning Technology Initiative, the initial evaluations reported that teachers modeled positive attitudes toward learning and teaching with technology. A major attitude shift in teachers was observed about accepting help from both staff and students in their buildings. Teachers from both pilot and non-pilot schools described how their role in the classroom had shifted as a result of laptop use. They characterized this shift as moving away from the role of "keeper of the knowledge" to one of "learner" within a "community of learners" in the classroom (Fairman, 2004). Moreover, by acknowledging students' skills and accepting help from students, teachers were demonstrating an attitude of respect toward students.

Teacher Beliefs

Some studies have pointed out that though the conditions for successful technology integration finally appear to be in place, including ready access to technology, increased training for teachers, and a favorable policy environment, high-level technology use is still surprisingly low (Ertmer, 2005, p. 25). Ertmer (p. 25) suggested, "Additional barriers, specifically related to teachers' pedagogical beliefs, may be at work." Cuban (1997) had a

similar observation that it is not a problem of resources, but a struggle over core values. Cuban (1993) also stated that the knowledge, beliefs, and attitudes that teachers have shape what they choose to do in their classrooms and explains the core of instructional practices that have endured over time. The low degree of success in many educational reforms has been seen as a major reason why teachers' instructional beliefs need to be considered (Fullan, 1993). It has been argued that teacher beliefs have a strong impact on teaching and learning (Handal, Bobis, & Grimison, 2001; Lovat & Smith, 1995). Teachers' instructional beliefs reflect personal theories of knowledge and knowing, and have been seen to influence teachers' curriculum decisions. According to Lovat and Smith (1995), teacher beliefs act as mental models driving teachers' practice and processing of new information. These instructional beliefs seem to act as mediators between curriculum goals and their actual implementation since teachers are to make curricular decisions based on their own affective and cognitive schemes.

In general, low level technology uses tend to be associated with teacher-centered practices while high-level uses tend to be associated with student-centered, or constructivist, practices (Becker, 1994; Becker & Riel, 1999). It has been seen that teachers who believe that students are capable of completing complex assignments on their own or in collaboration with peers may be more likely to assign extended projects that require laptop use and to allow students to choose the topics for their own research projects. Teachers who view technology as a tool with a wide variety of potential applications are more likely to use laptops often with students. Also, those teachers who believe that there are adequate software and Internet-based resources available to help teach their particular content area may use

laptops with students more often than teachers who believe that there are simply not enough high-quality materials available.

Lovat & Smith (1995) conceptualized teachers' beliefs as a set of assumptions that teachers hold on various educational processes such as curriculum, schooling, students, teaching and learning, and knowledge. The term teachers' belief has been used to represent teachers' conceptions, practical knowledge, personal knowledge, and experiential knowledge" (Anderson & Bird, 199; Marland, 1994; Pajares, 1992). For this study, teachers' beliefs include their educational beliefs about teaching and learning (i.e., pedagogical beliefs), and their beliefs about technology (Ertmer, 2005; Windschitl & Sahl, 2002).

Pajares (1992, p. 327) stated, "little will have been accomplished if research into educational beliefs fails to provide insights into the relationship between beliefs . . . and teacher practices, teacher knowledge, and student outcomes." Furthermore, "when beliefs are clearly conceptualized, when their key assumptions are examined, when precise meanings are consistently understood and when specific belief constructs are properly assessed, they can be the single most important construct in educational research" (p. 329). While previous researchers have documented the influence of teachers' pedagogical beliefs on classroom practices related to teaching mathematics (Vacc & Bright, 1999), science (Czerniak & Lumpe, 1996), history (Wilson & Wineburg, 1988), and literacy (Fang, 1996), Ertmer (2005) sought to examine relationship between teachers' pedagogical beliefs and their technology practices.

Ertmer (2005) conducted a study to understand the complex relationship between teachers' beliefs and their technology practices, to gain insights into why teachers are not

using technology in ways advocated in the literature. According to Ertmer, a great deal of empirical evidence has established the significance of beliefs for understanding teacher behavior. For example, Kagan (1992, p. 66) stated, “Empirical studies have yielded quite consistent findings: A teacher’s beliefs tend to be associated with a congruent style of teaching that is often evident across different classes and grade levels." In fact, given that the knowledge base of teaching consists of few, if any, indisputable “truths,” Kagan postulated, “most of a teacher’s professional knowledge can be regarded more accurately as a belief” (p. 73).

In an earlier study, Ertmer et al. (2001) reported that teacher’ visions for, or beliefs about, classroom technology use did not always match their classroom practices: Despite the fact that most of the teachers described themselves as having constructivist philosophies, they implemented technology in ways that might best be described as representing a mixed approach, at times engaging their students in authentic, project-based work, but at other times asking them to complete tutorials, practice skills, and learn isolated facts. Teachers’ explanations for these inconsistencies include contextual constraints, such as curricular requirements, or social pressure exerted by parents, peers, or administrators. Moreover, Kagan (1992), Kane et al. (2002), and Nespor (1987) proposed that because beliefs exist in tacit form, understanding teachers’ beliefs requires making inferences based on what teachers say, intend, and do. If individuals are unable, or unwilling, to accurately represent their beliefs, this can lead to misjudging or misrepresenting that which truly motivates their behavior. Munby (1982, p. 216) added that when beliefs about a particular subject area are inconsistent with a teacher’s practice in that area, it may just be that “different and weightier”

beliefs are the cause. Ertmer (2005) gives an example to illustrate why it is important understand teacher beliefs and to determine which belief exactly influences which action: Although teachers may express the belief that technology is best used for high-level problem-solving activities, their day-to-day uses may include a large number of drill-and-practice applications, because they hold a more central belief that teachers are responsible for assuring that their students learn foundational, or prerequisite, skills. The problem, then, lies in sorting through these apparent contradictions to determine which beliefs, exactly, are influencing which actions. Nespor (1987) postulated that the potential power of beliefs as an influence on behavior is inherently related to the nature of beliefs. He further stated that belief systems, unlike knowledge systems, do not require group consensus, and thus may be quite idiosyncratic. This may explain why two teachers who know the same things about technology might believe different things about its use (e.g., one seeing it as a blessing; the other as a curse).

Based on the reported relationship between teachers' beliefs and their implementation of reform initiatives, Niederhauser and Stoddart (2001) suggested that teachers use technology in ways that are consistent with their personal beliefs about curriculum and instructional practice. That is, if technology is presented as a tool for enacting student-centered curricula, teachers with teacher-centered beliefs are less likely to use the tool as advocated. Rather, they are more likely to use it, if at all, to support the kinds of traditional activities with which they are comfortable. The study conducted by Ertmer (2005, p.32) also suggests three strategies for promoting change in teacher beliefs about teaching and learning, in general, and beliefs about technology, specifically: (a) personal experiences, (b) vicarious

experiences, and (c) social-cultural influences. Ertmer suggested that "if beliefs are formed through personal experience, then changes in beliefs might also be facilitated through experience" (p.32). Guskey (1986) argued that change in beliefs follows, rather than precedes practice, and that by helping teachers adopt new practices that are successful, the associated beliefs will also change. According to Nespor (1987), instructional change is not a matter of completely abandoning beliefs, but of gradually replacing them with more relevant beliefs, which Dwyer, Ringstaff, and Sandholtz (1990) suggested are shaped by personal experiences in an "altered" context. Second, the power of vicarious experiences for building teacher confidence and competence is supported by both the self-efficacy literature and the literature on technology professional development (Bandura, 1997; Downes, 1993; Handler, 1993). Vicarious experiences are considered to be a powerful learning tool because observing similar others serves both informational and motivational functions (Schunk, 2000). That is, models cannot only provide information about how to enact specific classroom strategies; they can also increase observers' confidence for generating the same behaviors. Third, according to Becker and Riel (1999), teachers' practices and beliefs are continually shaped by their ongoing experiences as teachers, by the values and opinions expressed by those around them, and by the expectations of influential others, all of which are transmitted through formal and informal norms, rules, and procedures. Putnam and Borko (2000) noted that teachers' practice is more likely to change as they participate in professional communities that discuss new materials, methods, and strategies, and that support the risk taking and struggle involved in transforming practice.

Case studies of teachers in laptop programs have shown that teachers' beliefs about students, the potential role of technology in learning, and the availability of high-quality digital content influence the degree to which they use laptops with students, and that there is evidence that particular program designs and factors affecting teacher attitudes and beliefs influence a program's implementation and success (Penuel, 2005). As for technology integration in classrooms, researchers have found that it is dependent on teacher's beliefs, and the affect it has on how and why they adopt new content, programs, and ways of teaching (Cuban, 1993; Fullan, 2001). Although most teachers today are quick to recognize the importance of using technology in their classrooms (Roblyer, 1993), numerous barriers can block implementation efforts. These barriers range from personal fears (What will I do if the technology fails and my lesson can't proceed? How will I gain the confidence I need?) to technical and logistical issues (How does this software package work? Where or when should I use computers?) to organizational and pedagogical concerns (How can I ensure that students obtain adequate computer time without missing other important content? How do I weave computers into current curricular demands?). Although teachers may not face all of these barriers, the literature suggests that any one of these barriers alone can significantly impede meaningful classroom use (Hadley & Sheingold, 1993; Hannafin & Savenye, 1993; Hativa & Lesgold, 1996). Schools therefore cannot undervalue teacher's beliefs; rather, there is a pressing need to examine the interacting factors of teachers' beliefs about computing, how these beliefs are shaped and, in turn, shape/ influence technology-integration practices in the context of actual classroom activities.

Findings from past one-to-one laptop programs have indicated that teachers have different beliefs about learning and teaching, and the use of laptops in classrooms. From the MLTI report, it can be inferred that the teachers who rated themselves as advanced or expert laptop users indicated a more frequent use of the laptop for instructional purposes than did those who rated themselves as novice, beginner, or intermediate users. Such evidence reinforce the idea that the process of incorporating the laptops into daily practice is developmental, and implementation and expertise will, in all likelihood increase as teachers become more comfortable with the technology. Other observations were that teachers who believe that students are capable of completing complex assignments on their own or in collaboration with peers may be more likely to assign extended projects that require laptop use and to allow students to choose the topics for their own research projects. Teachers who view technology as a tool with a wide variety of potential applications are more likely to use laptops often with students. Also, those teachers who believe that there are adequate software and Internet-based resources available to help teach their particular content area may use laptops with students more often than teachers who believe that there are simply not enough high-quality materials available. Many of the teachers reported that their expectations of what their students could do changed after seeing how skilled students were with using multimedia tools, and they then began assigning more complex and challenging work to students

Moreover, teachers from MLTI believed that the amount and quality of support they received had a great impact on their success in MLTI, and that this support begins at the state level, but also includes regional and local support. In addition to the technical concerns,

teachers indicated the need for more time and professional development, which included time to explore and learn how to use the technology. Teachers believed that if they were given more time to explore and learn about technology, they would be in a better position to integrate technology effectively in their classrooms.

Another major finding from the Maine report mentions many changes that took place in classrooms at different levels. Teachers believed that ubiquitous computing brought about changes in the relationships between teachers and students and teachers and teachers. The introduction of one-to-one wireless computing in middle school classrooms in Maine put students into the role of "teacher" and teachers into the role of "learner" with regard to the knowledge of computer technology. Students' role as "teachers" of technology generally took two forms: students helping/teaching other students in the classroom, and students helping/teaching teachers. Teachers from both pilot and non-pilot schools described how their role in the classroom had shifted as a result of laptop use. Teachers believed their relationship with students was becoming more "reciprocal" since the introduction of the laptops.

Even in TIP, the preliminary evaluation report stated that the greatest barriers to implementation involved people (Shapley et al., 2006). Teachers were at different stages of readiness for immersion and their receptivity varied. It was found that decisions about how and the frequency of laptop usage for teaching and learning depended on each teacher's readiness and preference. Though teachers at immersed schools, as a whole, made substantial progress in the first year, teacher proficiency and laptop use varied greatly by teacher, subject area, and school. Survey results showed that more experienced teachers and male teachers in

middle schools viewed themselves as less proficient, used technology significantly less often, and expressed lower level of support for technology integration. Responses from classroom observations and fieldwork also suggest that in the initial stages of implementation, most teachers maintained their existing pedagogical practices. Teachers typically had students use laptops to do the same kinds of activities they previously had completed with paper and pencil, such as completing worksheets, typing vocabulary words and definitions, or reviewing for multiple-choice tests. This finding is consistent with research showing that teachers progress through developmental stages while learning to create technology-infused classroom environments. Many teachers at immersed campuses appeared to be at the "adoption" or "adaptation" phases, as they were using technology to support traditional instruction or integrating new technology into traditional classroom practice (Apple Computer Inc., 1995). Teachers at immersed campuses also received a wealth of digital resources as part of their immersion packages. It was seen that in the first year, most of the teachers participated in professional development aimed at increasing their familiarity with the resources, but they seldom used the new digital products, and were seen to maintain previous methods of teaching.

In the initial evaluation report by Bebell & Russel (2006), it was observed that the BWLI teachers overall believed that technology can play a positive role for teaching and learning. Majorities of the BWLI respondents also report quite positive beliefs towards technology in both pre and post survey administrations. After five months into the implementation, changes were observed in the use of technology; in addition to the increases in technology usage, teachers were seen to demonstrate the philosophy and underlying

beliefs of the BWLI project goals and aims. Furthermore, teachers reported actively participating in a wide variety of BWLI-related professional development opportunities and appeared largely satisfied with those offerings. It was found that decisions about how and the frequency of laptop usage for teaching and learning depended on each teacher's readiness and preference.

Barriers to Technology Integration

Ertmer, Addison, Lane, Ross, and Woods (1999), conducted research to examine the barriers to technology integration by interviewing and observing primary teachers, to gain insights into teachers' interpretations of how these different barriers affect ongoing efforts to make technology "work" in their individual classrooms. 'Technology integration' is a common term in the educational technology community that represents the multiple ways that technology can be used to support educational goals and activities. Integration of technology into classroom instruction may include either teacher or student use of computers. Technology integration often also refers to administrative uses of technology to develop curriculum, communicate with educational stakeholders, and analyze data related to student academic achievement. Technology integration is achieved when the use of technology is routine and transparent, and when a child or a teacher doesn't stop to think that he or she is using a computer or researching via the internet (George Lucas Foundation, 2004). The authors classified these barriers into the first-order (incremental, institutional) and second-order (fundamental, personal) barriers that hinder teachers' technology integration efforts.

First order barriers (external) included the practical aspects of implementation such as availability of hardware and software, administrative support and insufficient time to prepare

instructional tasks. The term first-order barriers refer to those obstacles that are extrinsic to teachers. Typically, these barriers are described in terms of the types of resources (e.g., equipment, time, training, support) that are either missing or inadequately provided in teachers' implementation environments (Means & Olson, 1997). Second order barriers (internal) refer to teachers' instructional beliefs and attitudes towards the implementation of technology in education and established classroom practices. According to the authors, the effect of many external barriers can be ameliorated by providing adequate training and by confronting teachers' beliefs.

Barriers that interfere with or impede fundamental change are referred to as second-order (Brickner, 1995). These barriers are typically rooted in teachers' underlying beliefs about teaching and learning and may not be immediately apparent to others or even to the teachers themselves (Kerr, 1996). Studies have suggests that second-order barriers are common among today's teachers (Hannafin & Savenye, 1993; Kerr, 1996; Riedl, 1995). Moreover, these barriers are often thought to cause more difficulties than first-order barriers (Dede, 1998; Fisher et al., 1996). This may be because they are less tangible than first-order barriers but also because they are more personal and more deeply ingrained. Ertmer et. al. in their study, also concluded that internal barriers were determinant in achieving higher levels of use of technology and argued that resistance to implement technology were still there even when external barriers were removed.

Although second-order barriers may not be readily observed, their presence often can be noted in the reasons teachers give for being frustrated by first-order barriers. For example, many teachers may feel that their efforts are constrained by limited equipment, yet their

reasons for wanting more computers may point to different goals and beliefs. Thus, by examining teachers' reasons for feeling frustrated, it can be understood how their goals for technology use, as well as their beliefs about the role of technology in the curriculum, may shape perceptions of, and responses to, first-order barriers. Changes in the classroom will not be very effective till teachers adopt more positive beliefs about technology. Therefore, if educators are to achieve fundamental, or second order changes in classroom teaching practices, they need to examine teachers themselves and the beliefs they hold about teaching, learning, and technology. As Marcinkiewicz (1993, p. 234) noted, "Full integration of computers into the educational system is a distant goal unless there is reconciliation between teachers and computers. To understand how to achieve integration, we need to study teachers and what makes them use computers." Educators will benefit from this information to better identify effective strategies for helping teachers address both the apparent first-order and underlying second-order barriers they face. Some literature also indicates that second-order barriers must be addressed prior to, or at least in conjunction with, the attainment of higher levels of integration (Hannafin & Savenye, 1993; Kerr, 1996). Since different barriers are likely to appear at different points in the integration process, teachers need effective strategies for dealing with both kinds of barriers.

CHAPTER 3

DESIGN AND METHODOLOGY

The purpose of this study is to understand the beliefs, attitudes, and concerns of teachers in Early College High schools towards one-to-one computing, during the implementation phase of the computing initiative. The study is guided by the following research questions:

1. What prior experiences do the teachers bring to one-to-one computing?
2. What are the teachers' beliefs, attitudes, and concerns towards one-to one computing?
3. What support do the teachers need during the adoption phase of the computing initiative?

This chapter explains the rationale for selecting a qualitative design, and describes the sample as well as the methods for data collection and analysis. Finally, this chapter will discuss validity and reliability and reflect on the effects of researcher bias on the study. The following table describes the research time line:

Table 1: Time Line for the Research Process

Date	Activity
November 2007	Pilot Study
January 4th- January 9th	Initial "meet and greet" visits to three Early College High Schools
January 22, 2008	IRB Approval received
January 22, 2008 – 28th February 2008	Principal approvals, scheduling interviews and data collection
15th February 2008 – 31st March 2008	Data Analysis

Design of Study

This study is based on interpretive qualitative inquiry (Merriam, 1998) seeking to understand the beliefs, attitudes, and concerns of teachers during the implementation phase of one-to-one computing initiative. The Qualitative research method was selected as the appropriate methodology for this study as it allows studying a phenomenon with depth and in detail (Patton, 2002). Qualitative research is guided by a set of assumptions intended to address the process and purpose of conducting research (Merriam, 1998). The key philosophical assumption as stated by Merriam and Simpson (2000) is, "the view that reality is constructed by individuals in interaction with their social worlds" (p. 97). As stated by Merriam & Simpson (1995), overall purposes of qualitative research are to achieve an understanding of how people make sense of their lives, to delineate the process (rather than outcome or product) of meaning making, and to describe how people interpret what they experience.

There are additional characteristics of qualitative research as stated by Merriam (1998). First, qualitative research is primarily an inductive research strategy. Qualitative research may be an appropriate strategy to use if there is little known about the problem as stated by Merriam and Simpson (1995, p.99):

> If there is a lack of theory or if existing theory does not adequately explain the phenomenon, hypothesis cannot be used to structure an investigation. Rather, a researcher goes into the field with intent of discovering the meaning a phenomenon has for those involved. What is uncovered is mediated through the researcher's own

perspective, resulting in an interpretation, description, or explanation of the phenomenon.

Next, the researcher is the primary instrument for data collection and analysis. Guba and Lincoln (1981) point out that in addition to responsiveness and adaptability, the researcher as primary instrument is also able to: consider the total context of the phenomenon rather than a particular segment; immediately process data as it is being collected, leading, if necessary to refining data collection procedures; clarify and summarize material, checking with respondents for accuracy of interpretation; and explore atypical or idiosyncratic responses (Merriam & Simpson, 1995).

Another characteristic of qualitative research is that it usually involves fieldwork. The researcher physically goes to the people, setting, site, or institution in order to observe behavior in its natural setting. Fieldwork involves becoming intimately involved with the study. Finally, qualitative research assumes that a richly descriptive end product will be produced by the researcher through detailed writings and rich imagery, supported by the use of the participants' own words and data found in documents, videotapes, and in other sources (Merriam, 1998).

As regards this subject of study, there have been studies carried out in the past that have shown that teacher beliefs about teaching and learning both affect initial levels of adoption and evolve when they begin to use computers (Collins, 1991;Cuban, 1986, 2001; Dwyer, Ringstaff & Sandwltz, 1991), though findings are not conclusive on how these processes take place and how teachers feel during the times of transition (cited by Burns & Polman, 2006). The existing literature on technology integration also shows that teachers

need assistance in learning to use computers as tools for teaching (Schwab & Foa, 2001), and that sustained group professional development can improve chances for meaningful and lasting integration (Blumenfeld et al., 1991), but the ideal level of training for different purposes and contexts remains elusive (Burns & Polman, 2006). Hence, there is need for more conclusive data on the implementation process of a computing initiative.

Unlike quantitative research, which posits that one objective reality exists and that reality is quantifiable and measurable (Crotty, 1998), the qualitative research paradigm allows researchers to inductively explore socially constructed meanings, not constraining them to fit within a predetermined set of categories of analysis (Patton, 2002). A qualitative methodology is thus appropriate since little is known about this phenomenon (Merriam & Simpson, 2000), and a qualitative study allows for rich descriptions of social phenomena (Merriam, 1998; Patton, 2002). This study therefore adopts a basic interpretive study, which is used to "discover and understand a phenomenon, a process, or the perspectives and worldviews of the people involved" (Merriam, 1998, p. 11). Qualitative researchers conducting a basic interpretive study are interested in 1) how people interpret their experiences, 2) how they construct their worlds, and 3) what meaning they attribute to their experiences (Merriam, 1998). Similarly, in this study, the researcher will seek to understand what experiences teachers go through while adopting one-to-one computing into their curriculum, and what their needs and concerns are regarding the implementation of laptop programs.

Sampling

Sampling is defined by Merriam (1998) as the selection of a research site, time, people, and events in field research. According to Le Compte and Preissle (1993) sampling has to do with representation of individuals and subsets making up the population group from which results can be generalized. For this study, a criterion based sample selection was used to select the site, and a voluntary or convenience sample was used to select the participants. The approach to selection of the site was guided by the purpose of the study, and the selection of participants was entirely dependant on limitations of time and teacher availability.

Site Selection

A criterion-based sample selection approach was employed to select the site for this study. The criterion based selection requires the researcher to "create a list of the attributes essential" to the study, and then "proceed to find or locate a unit matching the list" (LeCompte & Preissle, 1993, p.70). The logic of criterion-based sampling is to review and study all cases that meet some pre-determined criterion of importance (Patton, 2002). The criteria used to select the site include the Early College High Schools that have been provided the laptops as part of the North Carolina one-to-one computing initiative, and where the teachers must be at the very beginning of the implementation phase of the one-to-one computing (i.e. within three months of receiving their laptops, and before the students receive their laptops).

Site Characteristics

The selected Early College High Schools are part of the North Carolina one-to-one laptop initiative, and they also form part of the New Schools Project. Participants were spread across four Early College High Schools in North Carolina. Three of these schools opened in Fall 2005, and one school opened in Fall 2006. Though unique in their own ways, these schools share certain characteristics and values in common. The goal of this program is to promote academic excellence and provide an opportunity for outstanding minority students with significant financial need to attend the college of their choice without the financial burden that can often prevent many highly qualified young people from pursuing a college education.

As part of the Early College High School design, these schools are located on community college campuses. The schools and colleges share resources and facilities and also coordinate schedules and calendars. They also co-design a four or five-year academic path for all students to provide, at no cost to the student, the opportunity to complete a high school diploma and an Associate's Degree or two years of transferable college credits. Such a design is intended to motivate students to higher achievement and model adult behavior for students (New Schools Project, 2008). High school students are treated as adults with no bells or hall monitors, and they are granted personal responsibility, trust, and encouragement. Students are treated as college students, and they see themselves as college completers. Some of the other common characteristics and values shared among these selected schools are that their classes are small and heterogeneously grouped, and class time is lengthened for in-depth sustained learning. The Early College High Schools are expected to have a

diverse student population, especially attending to those students who are less likely to see themselves as college completers. The classes have no more than 100 students per grade level, which aims at creating a learning community for students and teachers and provides opportunities for flexible and innovative structures to support students academically and emotionally. The core belief is that a personalized learning experience be afforded to every student, and these schools aim at giving these students the required attention for their academic, affective, and social needs. Also, for the teachers, collaborative lesson planning is a norm in these schools, and meeting time for small, professional teacher groups is built into the school's schedule and occurs daily or weekly.

Participant Selection

Participation in this study was voluntary. In order to identify potential participants in each of these schools, the researcher first made contact with each of the principals of the seven Early College High Schools via emails, requesting their approval to contact the teachers for the study, as well as to obtain the email ids of the teachers. Some principals expressed reluctance for their teachers to participate in a small study with so many bigger evaluations occurring simultaneously with the researcher's study. Four principals responded, with their approval to talk to the teachers. Based on the approval from the principals, the researcher then emailed the teachers for participation in the study. The recruitment letter is attached in Appendix A. The teachers were also sent the consent form to read and provide consent to be interviewed in an audio-recorded interview or a focus group. The consent form is attached in Appendix B. After constant follow-ups, the researcher was able to schedule four telephonic, one-to-one, semi structured interviews, and one face-to-face interview with

teachers who volunteered from four different schools; and one focus group with four teachers at a volunteer school.

Participants were thus selected using voluntary or convenience sampling. Convenience samples are also referred to as Volunteer samples in qualitative research (Polit and Beck, 2004). Bloor and Wood (2006) stated that if a population of interest is particularly hard to access, researchers might adopt sampling methods such as volunteer sampling. Volunteer sampling involves respondents agreeing to work with a researcher. Volunteer samples are likely to be used when researchers need to have potential participants come forward and identify themselves. Similarly, convenience samples involve selection of cases on the basis of their availability. This method may be useful when researching hard-to access populations, although clearly there are problems with selection bias (Bloor & Wood, 2006), and this sample type may not provide the most information-rich sources (Polit & Beck, 2004).

It was observed that, though the teachers were willing to participate and share their experiences regarding the laptop initiative, their "work pressure" generally did not allow them to provide the researcher any time for an interview. A number of teachers refused participation in the researcher's study in spite of their initial consent, mainly stating work overload and paucity of time as the major reason as they were being asked to participate in a number of evaluations that were occurring simultaneously with the researcher's study. The teachers were "overwhelmed" with the extra work such as responding to surveys, hosting site visitors in their classrooms for observations, participating in teacher focus groups, and

accommodating student release for student focus groups. The researcher therefore sought to a volunteer or a convenience sample.

Data Collection

The entire process of sample selection and data collection took almost one and a half months, from mid January 2008, to February 2008. Having been limited by time, and the teacher availability, the method of gathering data was entirely based on the time the schools allowed for the same. Most volunteer participants preferred to be interviewed telephonically, and while some preferred to be interviewed in the evenings after school hours, others preferred the planning time in the morning. One school gave an hour of their planning time with four volunteer teachers, and the researcher chose to conduct a focus group so as to be able to get inputs from the most persons in a limited time.

Data were collected using two methods: one-to-one, semi-structured, interviews (Appendix D) and focus groups (Appendix E). Apart from these sources, the researcher maintained a research journal with notes during the entire data collection process. In combined uses of qualitative methods, the goal is to use each method so that it contributes something unique to the researcher's understanding of the phenomenon under study (Morgan, 1997). Using multiple data collection methods helps to diminish bias by increasing the wealth of information available to the researcher (Hutchinson, 1990).

The process of data collection proceeded as follows: 1) email invites were sent to participants to elicit their participation for the study, along with the consent form as per the Institutional Review Board regulations; 2) participants gave their consent to participate in an

audio-recorded interview and/or a focus group; and 3) participants participated in an audio-taped interview for 30-45 minutes, or a focus group of 60 minutes duration.

Interviews

The primary source of data collection was telephonic, one-to-one, semi structured interviews. Interviewing is defined by Janesick (1998, p. 30) as "a meeting of two persons to exchange information and ideas through questions and responses, resulting in communication and joint construction of meaning about a particular topic." Patton (2002) states that the purpose of interviews is to gain insight into another individual's perspective. And, according to Merriam (1998), when it is not possible to observe a behavior, interviewing is necessary. This study employed semi-structured, open-ended questions (Patton, 2002) for the interviews (Appendix D). In a semi-structured format, the interviewer is generally required to ask specific questions, but uses probing questions as follow-up to elicit greater response from participants (Ackroyd & Hughes, 1992). Each interview process began with an informal conversation to explain the purpose of the study, and to go over the consent form and confidentiality agreement. All the interviews were audio taped. The researcher referred to the interview guide for the interview process, and added probing questions whenever needed to elicit relevant responses from the participants.

Interviews, as with other forms of data collection, have limitations. These limitations include the subjectivity of the researcher, possible distortion of data because of false or misleading data, biases of both interviewer and interviewee, and a lack of information forthcoming from interviewees. Each of these limitations can be reduced by a careful selection of interviewees and questions, and by the interviewer refraining from arguing,

being sensitive to verbal and nonverbal messages from interviewees, and being a reflective listener (Merriam, 1988). For this study, during the data collection, the researcher had to change the sequence of the questions and sometimes probe a little more, depending upon the responses received from the participants, and the understanding of the questions by the participants. The researcher used clarifications, restatement, and explanations (Merriam & Simpson, 1995) to elicit responses from participants as and when appropriate.

Focus Groups

Focus groups were used as a second method of data collection, along with one-to-one interviews. Morgan (1997) stated different uses for focus groups. First, they can be used as a self contained method in studies in which they serve as the principal source of data. Second, they can be used as supplementary source of data in studies that rely on some other primary method such as survey. Third, they can be used in multi-method studies that combine two or more means of gathering data in which no one primary method determines the use of the others. In multi-method uses, such as this study, focus groups typically add data that are gathered through other qualitative methods, such as participation observation and individual interviews. The model here is ethnography, (Morgan, 1997, p.3) which has traditionally involved a blend of observation and individual interviewing.

Focus groups have many advantages as a data collection method. The main advantage is the opportunity to observe a concentrated set of interactions on a topic in a limited period of time. Another source of strength for focus groups is their reliance on interaction in the group to produce the data. As Morgan and Krueger (1993) note, the comparisons that participants make among each other's experiences and opinions are a valuable source of

insights into complex behaviors and motivations. This too produces a corresponding weakness, as the group itself may influence the nature of the data it produces. The concerns for focus groups include both a tendency towards conformity, in which some participants withhold things that they might say in private, and a tendency toward "polarization," in which some participants express more extreme views in a group than in private (Sussman, Burton, Dent, Stacy, & Flay, 1991). A similar concern is also raised regarding the ability of any particular set of participants to discuss a particular topic, in which the participant's involvement is either too low or too high. If the participant's involvement in a particular topic is low, the researcher may only get scattered instances of the desired material, but if the participant is highly involved with the topic, the researcher may have to work hard to control the discussion. Also, focus groups are largely limited to verbal behavior and self reported data, and require greater attention to the role of the moderator and provide less depth and detail about the opinions and experiences of any given participant.

Data Analysis

Data analysis is the process of making sense or meaning out of the data (Merriam, 1998). Creswell (1998, p. 154) describes data analysis as "a process of pulling the data apart and putting them back together again in more meaningful ways." The analysis of data for this study was based on the guidelines of the constant comparative method. In this method of analyzing qualitative data, devised by Glaser and Strauss (1967):

> Data in the form of field notes, observations, interviews, and the like are coded inductively, and then each segment of the data is taken in turn and, a) compared to one or more categories to determine its relevance and b) compared with other segments of data similarly categorized. As segments are compared, new analytic categories as well as new relationships between categories may be discovered" (Scwhwandt, 2007, p.37).

According to Merriam & Simpson (1995), the constant comparative method follows four distinct stages. In the first stage, one compares incidents, generates tentative categories and/or properties to cover the incidents, and codes each incident into as many tentative categories as are appropriate. In the second stage, the comparison of units changes from "incident with incident" to "incident with properties of the category" (Glaser & Strauss, 1967, p. 108). The researcher attempts to integrate categories and their properties. The third stage is categorized by the delimitation of theory. Similar categories are reduced to a smaller number of highly conceptual categories; hypotheses are generated; data are further checked for their "fit" into overall framework. The simultaneous collection and analysis of data end when the categories become saturated. The fourth stage is the actual writing of the theory from coded data and memos that "occurs when the researcher is convinced that his analytic framework forms a systematic substantive theory, that it is a reasonable accurate statement of the matters studied, and that it is couched in a form that others going into the field could use" (Glaser & Strauss, 1967, p.113).

Struass & Corbin (1990, 1998) proposed three phases of coding for the constant comparative method, which are: Open Coding, Axial Coding, and Selective Coding. For this

study, the researcher chose to follow the constant comparative approach as given by Strauss & Corbin (1990, 1998) as they suggested a more structured approach to analysis through their constant comparative technique, and this approach was more understandable for the researcher in terms of its applicability to this study. The process is explained below:

In the Open Coding Phase, the researcher examines the text (e.g., transcripts, field notes, documents) for salient categories of information supported by the text. Using the constant comparative approach, the researcher attempts to saturate the "categories," or look for instances that represent the category and to continue looking (and interviewing) until the new information obtained does not provide further insight into the category. These categories are composed of subcategories, called "properties" that represent multiple perspectives about the categories. For example, during the process of data analysis for this study, the researcher first read the participant responses multiple times, noting recurring themes, and highlighting representative and unique expressions, in order to develop a more in-depth understanding of comments made by participants during this phase of "open coding" (Corbin & Strauss, 1990; Strauss & Corbin, 1990). An example of the open coding process is as follows:

Table 2: Example of Open Coding from Interview Transcript

Quote From Transcripts	Open Coding For The Quote
At the moment, our biggest concern is about the insurance	Concern about student laptop insurance
We do not have the promethean boards yet so we can't change a lot of our instruction	Need for Supplemental Resources
How can I check their history to see if they've not went on different pages and stuff like that?	Monitoring Student Misuse Of Internet
We have to have a technology facilitator for the laptop initiative, and we do not have one.	Need for technology facilitator
When are we going to store the computers with a safe? Charge the computers every day?	Concerns regarding lack of Information about everyday laptop usage

The second stage of data analysis is "axial coding," where the researcher takes "bits" of data identified in open coding and put them back together in new ways by making connections between codes (Strauss & Corbin, 1990; 1998). In the Axial Coding Phase, the researcher identifies a single category from the open coding list as the central phenomenon of interest, and reviews the database again to provide insights into specific coding categories that relate or explain the central phenomenon. These are "casual conditions that influence the

central phenomenon, the strategies for addressing the phenomenon, the context and intervening conditions that shape the strategies, and the consequences of undertaking the strategies" (Creswell, 2007, p.161). The researcher took the open codes, and developed axial codes from them by grouping together like ideas. An example is as follows:

Table 3: Example of Axial Coding from Open Codes

Open Coding	Axial Coding
Concern about student laptop insurance	Information (regarding policy for student Insurance)
Need for Supplemental Resources	Support (for Supplemental Resources)
Monitoring Student Misuse Of Internet	Training on (Wireless Classroom Management)
Need for technology facilitator	Support (from Technology Facilitator)
Concerns regarding lack of Information about everyday laptop usage	Information (regarding policies, procedures, protocols)

The purpose of axial coding is to group the codes in order to form categories. "Categories have conceptual powers because they are able to pull together around them other groups of concepts or subcategories" (Strauss & Corbin 1990, p. 65). Further, the categories, which emerged from the data, were "saturated" during the coding process (i.e. no further categories emerged when the data were re-examined). The researcher employed constant comparison by reading and re-reading the data until no further categories presented themselves. The following table is an example of this process:

Table 4: Example of Categorizing from Axial Codes

Axial Coding	Categories
Information (regarding policy for student Insurance)	Communication
Support (for Supplemental Resources)	Support
Training On Classroom Management	Professional Development
Support (from Technology Facilitator)	Support
Information (regarding policies, procedures, protocols)	Communication

Finally, the categories were compared with each other, to arrive at major categories and themes that emerged out of the entire analysis process. Another memo was generated at this stage to describe what was contained within each category. An example is shown in the following table:

Table 5: Example of Memo from Analysis of Categories

1. Communication • Vision and goals of the laptop program • Policies, procedures and protocols related to student and teacher laptop usage
2. Support • Technical support for hardware and software related issues • Technology support for curriculum related issues • Infrastructure • Supplemental resources like LCD projectors and smart boards

Table 5 continued.

3. Professional Development
    - Technology Skills
    - Classroom Management in wireless classrooms
    - Technology integration into curriculum

In the Selective Coding Phase, information from the axial coding phase is organized into a figure, or a coding paradigm, which presents the theoretical model of the process under study. In this way, a theory is built or generated. Finally, from this theory, the researcher generates propositions or hypotheses that interrelate the categories in the coding paradigm.

A constant comparison model is thus a concept-indicator model of analysis wherein empirical indicators from the data (actions and events observed, recorded, or described in documents in the words of interviewees and respondents) are compared looking for similarities and differences. Following this process, the researcher endeavored to identify the underlying uniformities in the indicators to produce coded categories or concepts, and compare them further with more empirical indicators and with each other to sharpen the definition of the concept and to define its properties. Theories may be formed from proposing plausible relationships among concepts and sets of concepts, although this study does not intend to formulate any theories.

Pilot Study Findings

The pilot study was conducted in November 2007, in a school that had recently been through the process of implementing the one-to-one computing program, though the nature of the school establishment differed from this study. The reason for conducting a pilot study was to test the instrument validity and develop a clear and usable instrument for the research study. The

school selected for the pilot study was a private middle school. The site selection was based on the criteria that the school had recently implemented a one-to-one computing initiative. The data were collected via an in-depth interview of a technology coordinator at this school. The interview questions were based on the three research questions: What prior experiences do the teachers bring to one-to-one computing? What are the teachers' beliefs, attitudes, and concerns towards one-to one computing? What support do the teachers need during the adoption phase of the computing initiative? After obtaining approval from the Institutional Review Board, the researcher contacted the technology coordinator to seek participation in the pilot study. Upon receiving the technology coordinator's consent, an audio-recorded, semi-structured, face-to-face interview was conducted with the participant.

Pilot Study Data Analysis

The interview tapes and the transcript from the pilot study were examined for patterns related to how teachers adopted the computing program, and the teacher attitudes, beliefs, and concerns that emerged during the adoption phase of the one-to-one computing initiative. Major categories that emerged were related to technology and the classroom environment. The infrastructure related to technology, and the hardware and software support mechanisms, were identified as important aspects of consideration in this school during the adoption of the computing initiative. Readily available technical support also appears to be an important factor for laptop programs to succeed. The participant's responses showed that teachers' beliefs about students, their confidence in themselves over the control of a wireless class, their perception of the potential role of technology in teaching, and the availability of high-quality support influence the degree to which they use laptops in classrooms. Moreover, it was concluded that professional development might need to address a lot of areas other than just technology familiarity.

The following figure represents the main categories, and sub-categories that emerged from the pilot study:

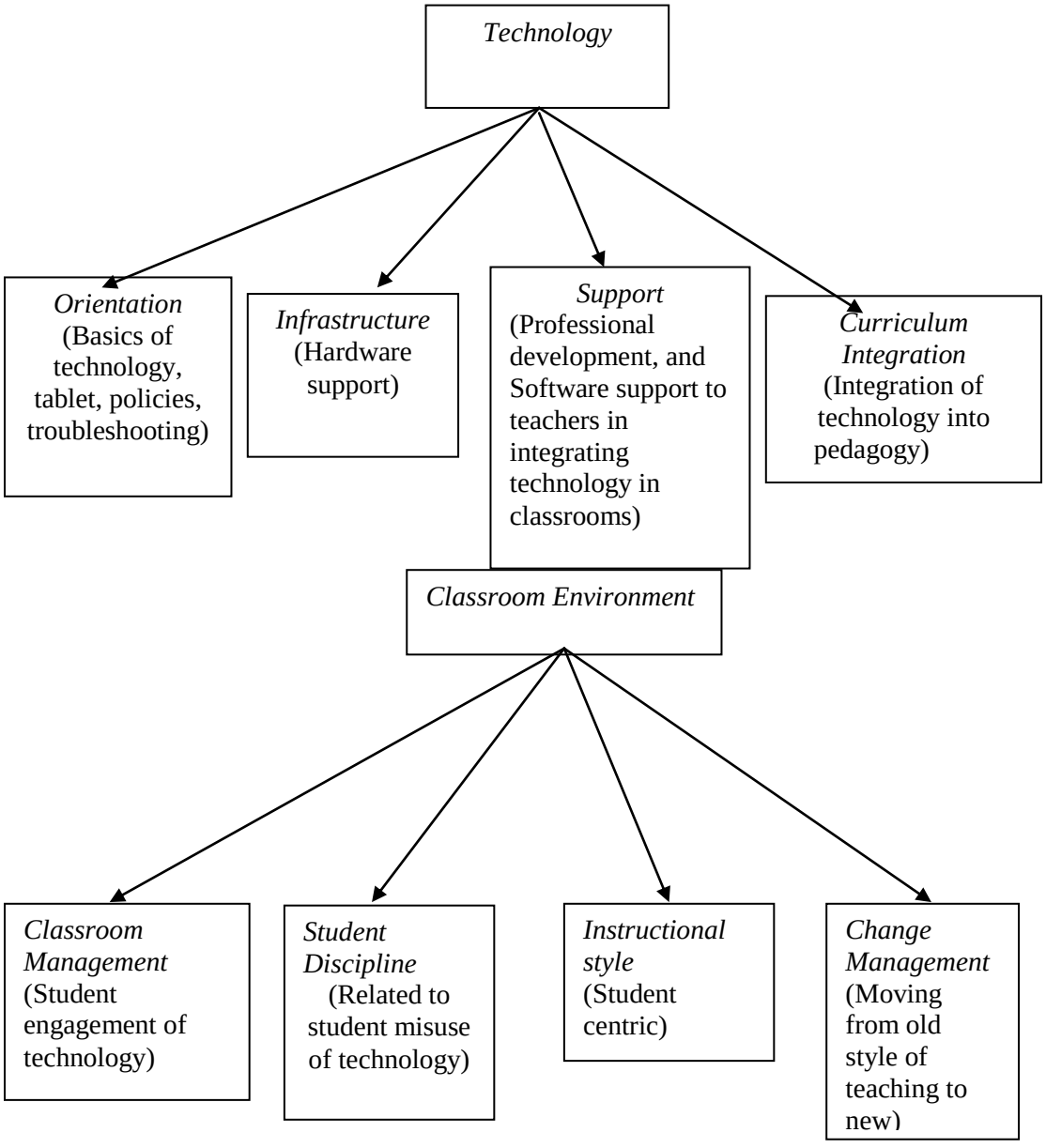

Figure 1: Categories that Emerged from the Pilot Study Analysis

Conclusions from Pilot Study

From the preliminary analysis, it was concluded that some relationship exists between how teachers perceive and value the one-to-one computing initiative, and their comfort level with using technology in classrooms, that affects their technology integration, and eventually student learning. The experience from the pilot study has helped guide the methodology of this study, and refinement of the interview questions. The pilot interview allowed the researcher to try out questions to determine if they are confusing and need rewording, and also to practice interviewing skills. The experience of conducting an interview on-site helped to understand the entire process involved, and the dos and don'ts in the field. The pilot study did reveal many necessary amendments in the interview questionnaire to improve comprehensibility, so as to be able to get data that are more relevant to the study. The researcher saw the need to add probing questions to help guide the responses towards the desired direction. Finally, from the pilot study, it was observed that there was a lot of scope for deeper analysis into the needs of teachers during the adoption of a one-to-one computing initiative. It was thus concluded that it would be worthwhile to interview the teachers directly, and get their responses to their beliefs and concerns regarding the one-to-one computing initiative. The researcher therefore targeted teachers as potential participants for the study on Early College High Schools, that are implementing the computing initiative as part of the North Carolina one-to-one computing program.

Validity and Reliability

This study used triangulation as the validation procedure, which serves as a mechanism for reducing bias and ensuring accurate interpretation of the data. In triangulation, researchers make use of multiple and different sources of methods, investigators, and theories to provide

corroborating evidence (Ely et al., 1991 ; Erlandson et al., 1993; Glesne & Peshkin, 1992; Lincoln & Guba, 1985; Merriam, 1998; Miles & Huberman, 1994; Patton, 1980, 1990). Multiple sources of data collection were employed, including interviews and focus groups, as well as a personal reflection journal maintained throughout the data collection process. For the interview and focus group, the researcher essentially becomes the research instrument (Merriam, 1995). Therefore, the validity of results rests more on the interviewing skills of the researcher than on the interview format. As stated by Merriam (1995, p. 150), "increasing the structure increases the consistency from one interview to the next." This study therefore used a semi-structured interview so as to be able to compare the data from different sources. Moreover, in this study, the researcher established the research questions prior to gathering data to get a general sense of direction when describing and interpreting this learning environment. Finally, the rigor of constant comparison data analysis methodology will ensure that the researcher maintains a sufficient detachment from theoretical and personal presumptions.

Reliability refers to the extent to which research findings can be replicated. "Reliability is problematic in the social sciences simply because human behavior is never static, nor is what many experience necessarily more reliable than what one-person experiences" (Merriam, 2002, p. 27). Since reliability most often has to do with the instrumentation of the study, and since the researcher is the primary instrument of data collection and analysis, the researcher can become a more reliable instrument through training and practice (Merriam, 2002; Rossman & Rallis, 2003). Reliability can be increased through triangulation as explained above. Also, reliability will be strengthened through an explanation of the researcher's subjectivities, including assumptions and biases about the research.

Researcher Subjectivities

The purpose of this section is to put forth the researcher's assumptions, experiences, and expectations of teaching and learning with technology. While the researcher does not consider herself an insider in this research, she does realize that the values and experiences that she carries can affect her subjectivity. She recognizes her assumptions and biases towards technology in enhancing education, whether it is for the children or adults. The researcher is a student of Instructional Technology, and is positively disposed towards the computing initiative, and the revolution that the initiatives like ubiquitous computing will bring about in the field of education. While new technologies are challenging academic structures and processes, the researcher feels that effective implementation of technology in schools, and positive changes in our traditional way of doing things will occur only if sound research is incorporated into the discussions and planning pertaining to teaching and learning. According to the researcher, a lot of professional development offered to teachers may not always address the real needs of the teachers, and are offered because these modules are already available or are being offered by different vendors as against being tailor made for teachers as per their particular needs and requirements. In conclusion, the researcher's background interest in technology in education, may bias her understanding of the insights the respondents share. Being aware of her subjectivities, it has been the researcher's endeavor to let the methodology and data guide her analysis, and not let her biases direct her interpretations.

Chapter Summary

This chapter outlines the qualitative design of this study and the procedures implemented to complete the data collection and data analysis. This chapter also discussed issues of validity and reliability and reflected on the researcher's biases and assumptions going in to the study.

CHAPTER 4

FINDINGS

The purpose of this study is to understand the beliefs, attitudes, and concerns of Early College High School teachers towards one-to-one computing, during the early adoption phase of the one-to-one computing initiative. The study will provide the opportunity to thoroughly understand the phenomena of teachers' adoption of technology, particularly in the Early College High School environment, and describe what actually takes place, from the teachers' descriptions of their personal experiences of integrating technology into their classroom. The main research questions that guide the study are:

1. What prior experiences do the teachers bring to one-to-one computing?
2. What are the teachers' beliefs, attitudes and concerns towards one-to one computing?
3. What support do the teachers need during the adoption phase of the computing initiative?

This chapter highlights the process of analysis while at the same time presents the responses of the participants. It also presents the participant teachers' descriptions of laptop implementation in their respective schools as well as their own experiences and views related to the laptop program. One-to-one, semi-structured interviews were conducted with five teachers from four different Early College High Schools, and a focus group with four teachers was conducted in one Early College High School. For both the one-to-one interviews, and the focus groups, transcription was completed within one week of the interviews. The audiotapes were transcribed verbatim into Word documents by a paid transcriber.

Participant Profile

The participants represented four of the seven selected Early College High Schools, that are part of the NC one-to-one laptop program. The participants also represented diversity of age, gender, and experience. As illustrated in Table 2, the sample consisted of three female teachers and two male teachers for the one-to-one, semi-structured interviews, and three males and one female teacher for the focus group. The subject areas taught by the participants included Math, English, Science, and Spanish. The age group ranged from twenty-seven years to sixty-two years of age, and the teaching experience ranged between three years to twenty-four years of experience. At the time of the interviews, the selected Early College High Schools were in the initial phase of adoption of the laptop program. Some teachers across the four schools were in the process of receiving laptops, while others had already received their laptops, but the students had not been given the laptops yet. The teachers had also attended some professional development related to the integration of laptops in classrooms. Apart from this, the schools were in the process of increasing their technology resources like projectors, printers, smart boards, as well as wireless access through all classrooms.

Table 6: Profile of the Research Participants

Name	School	Gender	Age (yrs)	Grade	Subject	Teaching Experience (yrs)	Frequency of use of computer
Susan	School 1	Female	31-35	9-12	Math	8	Daily
Mary	School 2	Female	36-40	9-12	Spanish	11-15	Daily
Liz	School 3	Female	59	9-10	English	27	Daily
Jeff	School 3	Male	41-45	9-12	Math	>16	Daily
Peter	School 4	Male	46-60	9-12	Science	3-5	Daily
FG Participant 1	School 4	Female	62	9-12	English	24	Daily

Table 6 continued.

FG Participant 2	School 4	Male	41-45	9-12	Math	>16	Daily
FG Participant 3	School 4	Male	26-30	10-12	Math	4-5	Daily
FG Participant 4	School 4	Male	46-60	9-12	Science	3-5	Daily

The profile of the participants of the one-to-one, semi-structured interviews is as follows:

Susan

Susan was the first volunteer participant to be interviewed telephonically from her school. Susan's certification is in secondary mathematics education, and she mainly teaches Algebra and Geometry to grades 9-12. She informed the researcher that she has a computer at home, and she uses a computer at home and in school daily. She sounded very comfortable with computers and was excited to talk about the one-to-one initiative. She enthusiastically spoke about how the computing initiative would positively impact student engagement, and prepare students for the 21st century workplace.

Mary

Mary was interviewed telephonically from her home in the evening. Mary is a Spanish teacher, who has been teaching for almost 15 years. She has a certification in secondary education. Though Mary uses computers on a daily basis, she expressed that she would need further training to hone her computer and technology skills. Mary had already received the laptop, but was concerned that the whole initiative was being "rushed" into.

Liz

Liz was interviewed in the morning, and she took the call from her home while on leave. Liz is an experienced English teacher, who has been teaching for the past twenty-six years. She has a Masters degree in Early Childhood, and had received some formal training in using computers. Liz was very interested in helping students conduct research on new educational initiatives, and volunteered to participate in the researcher's study. She also has a computer at home, and uses it daily. Though Liz seemed open to learning new ways of teaching, she had concerns about being judged based on student scores, and was looking forward to professional development specific to technology integration in her subject area.

Jeff

Jeff was interviewed in the evening, and he took the call from his home. When the researcher called Jeff, he did not remember that he had an interview scheduled, but was willing to be interviewed by the researcher anyway. His responses were short and to the point. Jeff came across as a senior teacher. He teaches Math to grades 9-12, and had been using computers in his classroom daily. Jeff viewed laptops as a "teaching tool" and not a " goal in itself", and expressed concerns about constantly being under scrutiny related to the computing initiative.

Peter

Peter is a science teacher, who teaches grades 9-12. The researcher conducted a face-to-face interview with Peter. Peter was also part of the focus group conducted by the researcher, along with other volunteer teachers in his school. Peter came across as a very energetic and enthusiastic person. Peter has a certification in secondary education, and is currently enrolled in a certification program in curriculum and instruction in a state university. Peter had been using computers for years, and seemed very comfortable with using computers; yet, he

doubted the reliability of technology, and did not want to completely depend on technology while teaching.

Findings from the study are presented based on each of the three research questions guiding the Study:

Research Question 1: What Prior Experiences do the Teachers Bring to One-to-One Computing?

To answer this research question, teachers were asked about their school's technology infrastructure to determine the tools they could already access prior to the laptop program, and they were asked about their own uses of technology in the classroom.

Access to School Technology Infrastructure Prior to One-to-One Computing

It was observed that though these schools were recently established, all provided various technological facilities for use by teachers and students, and the participant teachers had been using various technologies in their classrooms prior to the one-to-one computing initiative. Overall, the study participants believed that their schools were "technologically friendly." Some schools were already equipped with advanced technological facilities like LCD projectors, and interactive whiteboards. Most of the teachers responded that they had access to technological resources like Computer On Wheels (COWs), TV, and VCRs, and TI 84 calculators, and therefore were "technologically familiar" already. Also, a majority of the schools also had access to 'computer rooms', which could be used by students for research and projects. But, some respondents indicated that access to computers was not adequate. Peter mentioned having limited access to COWs:

> But access has been limited because those things are in two classrooms and are not available all day in every class. We're figuring that with the one to one initiative we

will be able to use computers as often as we can, offsite, and have a lot more interaction with the students that are not necessarily tied to the classroom on any given day.

Also, most of the participant teachers had Internet access in the classrooms or their schools were in the process of establishing wireless access in the school. From teacher comments, it can easily be concluded that the volunteer teachers felt that they already had a "technological advantage over other high schools" since they had available different kinds of technology prior to the one-to-one computing initiative, which would stand to their advantage in adapting to a ubiquitous computing environment.

Teachers' Prior Experiences with Using Technology

Prior instructional technology use for this study will be defined as the prior use of computer technology for instructional purposes. Some interview questions targeted obtaining responses from teachers pertaining to their instructional technology use in their classrooms prior to the laptop program. It is evident from the participant's responses to interview questions, as well as the demographic questions that all participant teachers had been using computers on a daily basis, for administrative or some form of instructional purposes. All study participants viewed technology as beneficial for students' motivation and engagement, and they sought to adapt technology in more creative ways for their students' motivation. It was seen that administrative use of technology was very common, though participating teachers themselves did not seem to comprehend the clear distinction between administrative and instructional use of technology. For example, Susan's response indicates administrative use of technology: "saving notes on flash drive," and having "notes electronically on computer" so that students "could use them as a template."

Instructional uses of technology mentioned by the study participants mainly included using projectors, and whiteboards for "projecting notes and images," and having students use the Internet for research and software like MS Word, PowerPoint, and Excel for class assignments. Liz gave an example when after finishing Frankenstein, she "sent the students to different websites to play and get a little more information." Susan, a math teacher responded:

> I do a lot of projects where I have them (students) do PowerPoint presentations in my Geometry class or Algebra II class, so they do have access to computers for research and PowerPoint and Excel, and different kinds of programs like that.

Peter, a science teacher reported spending a "lot of time finding things as good illustrations and examples on the Internet," and using those examples in the classroom since the textbooks are "out of date by the time they're finished coming off the printing press," and there are "newer, more interesting" information available that could be used in classroom activities. Nearly all participants reported that they used computers daily in their classrooms, both for their own use and for the use of their students. Teacher comments show how participants have integrated various technology into classrooms, including TI 84 calculators, cameras, LCD projectors for projection of notes, white boards, laptops for PowerPoint, emailing, and internet for research. Though the levels of technology usage ranged from low to moderate, it seems that the availability and access to various technological resources has served as a catalyst and a precursor to the teacher's increasing interest in integrating technology into their instruction.

Research Question 2: What are the Teachers' Beliefs, Attitudes and Concerns Towards One-to-One Computing?

Teacher Beliefs and attitudes towards one-to-one computing

When asked how the laptop program would impact the students, the results revealed that most participant teachers possessed positive attitudes towards one-to-one computing and its impact on students. Teachers were excited about one-to-one computing for several reasons, which included giving their students more active control over their own learning by "putting learning at their fingertips," making learning "easier and fun" for students, providing an opportunity to "prepare students for the global market place," and "opening doors to new opportunities" for students who might not have been able to do "something like this on a normal basis." The study volunteers showed a general awareness of the innovation, and were eager, excited, and willing to gain information. It was seen that all participant teachers felt that the laptops would positively impact students. In Susan's words:

> Well I think it will make them (students) excited about the classroom. This puts learning at their fingertips; they're able to have control of the situation.

Susan expressed her belief that laptops would greatly benefit students and that the technology would prepare them for the global market, where "they're going to have to be able to use the computers and they'll have more confidence in how to do that working with these in our classrooms." Teachers perceived that students "learn this stuff (technology) faster," and that student might even be able to "teach the teachers how to use these programs." This was evident from FG participant 3's comment:

> It will give the students more initiative to be independent learners because they have everything at their fingertips to find and research and answer questions that they didn't have necessarily before.

In spite of acknowledging that there were issues related to the implementation of the computing program, the participant teachers, overall looked forward to it, and expressed enthusiasm about the laptop program as they felt it would open doors to new opportunities for students, and "totally change the classroom and how we do things." Since the students would be allowed to keep the laptops with them all day, and also be able to take them home, teachers were excited that it would change the "dynamics of classroom teaching" and student-teacher interactions. Beyond how teachers saw laptops helping their students, they also indicated they were excited about laptops helping them teach differently, and in Mary's words:

> They will also be able to watch videos and do more listening comprehension type things. Right now they just see the textbook and me. But these laptops will help them see videos, see newspapers, real information. Not just whatever I bring them.

Overall, the study participants also expressed great interest in getting to use the laptops in more creative ways so as to better "engage the students." Jeff particularly believed that laptops be seen as a "teaching tool" and not "a goal in itself." Like Jeff, Liz also expressed that there may be times when "we would set them aside," and "need to do other things." While the participant teachers showed positive attitude towards the computing initiative, there were undercurrents of apprehensions and fear, mainly due to lack of adequate information to teachers. Mary remarked:

> I'm excited, but I'm also kind of terrified. Really, I don't think we have the things in place that we need to have to implement it yet.

When asked if the teachers were aware of the school's vision for the laptop program, not many participants said they were formally communicated the goals and vision for the laptop program, though they did have their own understanding of how the laptops would be beneficial for their schools, like Susan responded, that it would lead to "a paperless school," and another participant, Mary explained that the vision was to would "help prepare students for the 21st century workplace."

Teacher Concerns regarding integration of one-to-one computing

The study participants voiced a number of concerns and anxieties related to the one-to-one computing program. Five major categories of concerns emerged including: need for support, need for professional development, wireless classroom management skills, better communication, and personal anxieties. A comment by Mary summarizes the general response received, "I don't think we have the things in place that we need to have to implement it yet. It's going to take a lot of time, it's also going to take a lot of manpower and training." Participant teachers voiced their fear at the possibility of being caught in a technology breakdown or malfunction situation in their classrooms, since none of the schools had a technology facilitator for immediate support. Similar to the following response by Mary, other participating teachers like Peter, Jeff, and FG Participant 1 also expressed concerns about technology breakdown:

> What happens when the computer starts breaking? If we don't have a person who can fix it, what's going to happen?

Participating teachers also had concerns about maintenance and support for " a couple hundred laptops running at the same time." FG participant 3 commented:

> When we have those technological burps it's a big deal…and if two out of eleven computers are not working, what's that going to be out of two hundred?

The second major category of concerns identified was classroom management, including teacher's concerns about added focus on having to act as "monitors" to "keep an eye on what students are doing," and the concern that they would constantly have to "overcome the inclination" of students to go off task because they have got a "new toy." Jeff expressed concerns about network problems, and Liz also mentioned concerns regarding slowing down of a network because of all students gaming at one time.

Another category of concern was regarding professional development based on teacher specific needs, and "more educational training." The participating teachers needed more training specific to their needs, for example Mary elaborated "DyKnow, troubleshooting the computer, how to hook the printer up, the projector, what can we download, and what can we not download, how to use iPods, Podcasts, for video, etc." Mary also commented that a major concern was "finding the time for all this training." The focus group participants also echoed this concern. The focus group participants mentioned that the trainings that took place out of school required a lot of planning not only for their students in their absence, but also for preparing lesson plans for the training sessions, and so they ended up "paying for them badly in time." FG participant 1 commented that schools were not left with enough planning days for the current semester, most of the trainings took place after school hours, so the study participants were concerned if they would be compensated for extra hours of work.

The fourth category of concerns that emerged was related to communication, which included lack of adequate information regarding policies and procedures for laptop use by students and teachers. Mary needed answers to questions like, "When are we going to store the computers with a safe? Charge the computers everyday?" She further stated that there was "excitement at first, and then disappointment" because of "lack of any information regarding the laptop program." There seemed to be a lot of unanswered questions that were mentioned by Mary, which were echoed by most participants as well, and which seemed to add to teachers' anxiety, such as:

> What's going to happen next school year when we have new students who need new laptops…we're talking about 5 months from now?

Finally, the researcher noticed a lot of concerns that were personal. Some participating teachers like Jeff and Peter expressed concerns that the one-to-one computing program and the early college program were being "closely scrutinized," which put a lot of pressure on them. Liz explained her concerns regarding student test scores:

> When I was at the high school I taught academically gifted freshman. Obviously my State scores were good. I am now teaching the same way, but have probably two academically gifted students out of forty. My scores are not going to be what they were earlier. People who look at the scores are like "well she's not teaching as well as she used to teach."

Teacher worries also included timing of the one-to-one computing implementation. FG participant 3 seemed overwhelmed by the "new stuff thrown at them," and found it hard to learn and focus on new software and programs, when they are in the middle of a school session. According to FG participant 3, if "sharing and learning new things is not done

correctly, it can slow things down," and if teachers were not able to figure out a software program, they would waste a whole period doing nothing. He further proposed "it would be nice to have a little more focus on one thing at a time." Also, over-stretched working hours was also a common concern among teachers, as FG participant 1 commented:

> I do minimum 50-60 hour week, and on top of that we've got to learn this new technology and that's a bit daunting.

Teachers were also concerned that the technology may not always "function the way it is expected to," which may cause wastage of class time, and would also demand being always ready with a backup lesson plan. A concern with the back up plan is that it may not always be as effective as the main plan. FG participant 2 described a recent experience of projector malfunction in the classroom, which took him "fifteen minutes of messing around to suddenly get it up to speed again" so he could project the things he wanted to project. The following figure depicts the five major categories of teacher concerns identified during this study:

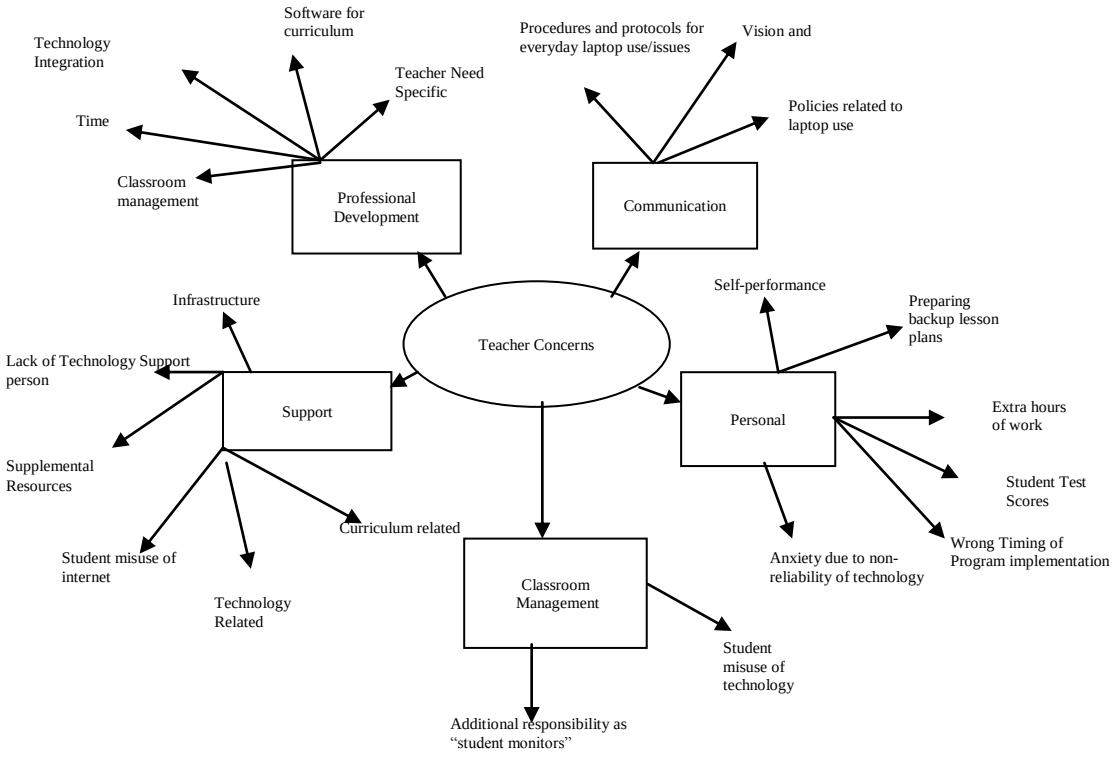

Figure 2: Teacher Concerns

Research Question 3: What Support do the Teachers Need during the Adoption Phase of the Computing Initiative?

A school implementing a laptop program may or may not have a deliberate thought out support strategy to help their teachers effectively adapt the educational innovation so as to ultimately meet the goals and vision of the laptop program for that school. The researcher through this study attempts to understand the teacher's perspective on what support do they need, in order to improve the chance of meeting teachers needs in a way that is effective for

them, so that the teachers can effectively, efficiently, and enthusiastically integrate technology into their classrooms. In addition to the concerns mentioned above that highlight the areas where support is needed, the teachers were also asked about what kinds of support they ideally needed during the adoption phase of the computing initiative, to best address these concerns. The researcher concluded that during this initial stage of implementation, it was witnessed that the demand for help from teachers was high, and the responses varied as per the individual's needs. This section presents the responses received from teachers pertaining to the support they need to address the categories of concerns identified above:

1. Teacher Needs Identified For Support Related Concerns

Technology support. Responses reveal an overall need for support with technology. Being able to call on in-house assistance can provide the reassurance and assistance that these participating teachers need, as can be summarized by FG Participant 4's comment:

> I think our concerns are the support for the technology and getting all the kinks ironed out before the students even receive the laptops, and technology support for when there are technical issues with computers-perhaps not working or not loading programs like they should be loaded.

Need for supplemental resources. Although funding has been provided to each school to support the adoption of technology, the demands seem to be far greater. Apart from the laptops, the responding teachers identified the need for supplemental resources like LCD projectors, smart boards, and multimedia software to support the integration of laptops in their subject areas. For example, Susan stated:

> I'm hoping its going to totally open up a whole new world when we get the Promethean boards and the laptops.

Software catering to specific subject areas. Apart from supplemental resources, some participating teachers responded that they needed software pertaining to their specific subject areas. While some teachers like Susan knew exactly what software to use, Liz wanted to know, "what is out there for English?" Susan had identified "Texas instruments Navigator" software for math and science classrooms:

> I've talked to our technology people at the school about Synchronize. I could send something to all the students and they could send it back to me. I would like to have training on how to do that.

Need for a technology expert to guide the adoption process. The participating teachers also identified a need for a technology facilitator "who knows what they're doing," and can guide the technology integration endeavor. Mary needed to have confidence in the qualifications and skills of the technology facilitator so that they could depend on the person for support and guidance for any technology integration related issue. The technology facilitator's function is perceived to be "more of a liaison to the students and a liaison between teachers and what's out there." Liz also expressed need for reliable support with curriculum:

> Another aspect of that would be to go to the person and say, "hey, can you find some things out there for me?" He could have some time to go out there and find me some websites.

2. *Teacher Needs Identified for Classroom Management Concerns*

Training to monitor student's misuse of Internet and technology. A need was identified for training for teachers to be able to monitor student use of Internet, and be "more

hands-on to make sure they (students) are doing what they need to be?" Susan described this training need as:

> Training on how to make sure that the computers are not being accessed as far as Internet and ways to block and filter and what those filters do. I'd like to know the works behind that because I know a lot of times you'll be in the classroom just walking around and what should you look for as far as students being on task and if they minimize it, how can I check their history to see if they've not went on different pages and stuff like that.

3. Teacher Needs Identified For Professional Development Related concerns

Need for teacher-specific and on-going professional development. The participating teachers demanded more professional development and training to be able to make maximum use of laptops in classrooms, and to explore the various functions it offers. Most participating teachers had only been to one or two professional development sessions, for example on SAS in Schools software. Mary, as well as other study volunteers like Peter and Liz conveyed the need for training on DyKnow classroom management software, basic troubleshooting skills, basic technology skills like how to hook up printers and projectors, how to download resources safely, and how to use iPods for pod casts and vodcasts. Apart from these, the responding teachers also needed curriculum-specific software training and also training to check student misuse of Internet. Liz remarked that the professional development that were offered did not meet the needs of individual's learning styles and requirements:

> I'm one of those old dogs who had to learn new tricks. I want to understand things. Not just be shown how to do it, but I want to understand. And too much of training is "here's how you do it."

4. Teacher Needs Identified For Communication related Concerns

Responses from the participants indicated they expected more communication and information regarding the laptop program: communication regarding the goals and vision of the laptop program; information regarding policies and procedures pertaining to student use of laptops, storage, charging of laptops, loss and damage; and also whom to contact for what issues, problems, or support. The "lack of information" had caused some disappointment as there were many unanswered questions pertaining to teachers' domain of work.

5. Teacher Needs Identified For Personal Concerns

Additional time for adoption. The participating teachers needed more time to learn new software, and to explore more creative ways to engage students. FG participant 3 suggested that they be given an intensive training week to learn the new resources, and to collaborate with other teachers, like setting up a Moodle professional network to support one another, and FG participant 4 added:

> I'd like a week or two where ... 3 or 4 of us go over there and say alright let's try getting a Moodle group and go back and forth and set this up and do some of that, but that's the problem whether it's the small trainings we go to or anything else, all of these things just need time and that's the precious commodity that nobody's got a bucket of behind their desk to go dip a little extra out of.

Compensation. The focus group participants were dissatisfied they were not given compensation for extra work in the form of rewards, or less workload for one semester to be able to explore and learn new resources and new ways of teaching. The teacher participants also felt that they should be supported by the school in terms of paying for additional teachers or substitutes to free up planning time during the implementation phase of one-to-

one computing. FG participant1 recommended that for one semester, “instead of teaching three classes teachers taught two, but got paid for the entire day.” Another recommendation that came from FG participant1 was:

> If I had a planning period a day for a semester, I could actually learn the software while I was teaching which is what we need to be able to do. Now unfortunately that would mean one whole other teacher for this school for every 4 people and education has never, so far, been willing to pay for that kind of training for its teachers, industry does but education doesn’t.

The following Figure 3 builds on Figure 2 and depicts the support strategies recommended by the study participants to address their major concerns.

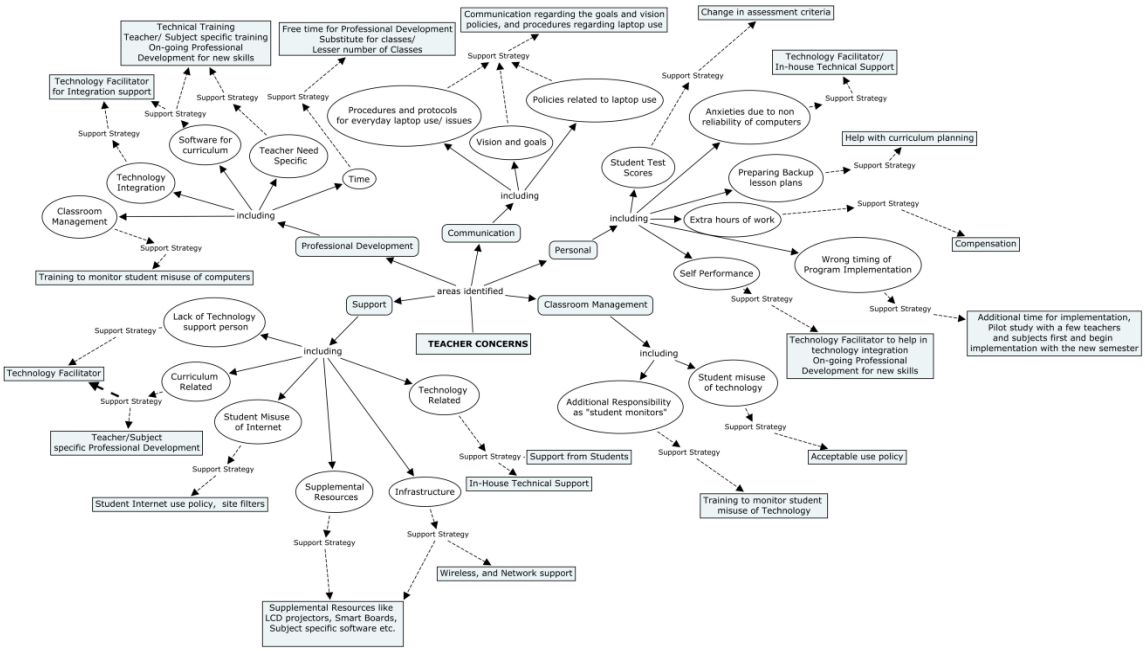

Figure 3: Support Strategies Recommended by Study Participants for Teacher Concerns Identified

Summary of Findings

The analysis of transcripts from the focus group and teacher interviews reveals the current level of preparedness of the participant teachers and schools for the one-to-one computing program. The researcher analyzed data using the constant comparative method (Struass & Corbin, 1990, 1998) to gain insights into the three research questions: 1) what prior experiences do the teachers bring to one-to-one computing? 2) what are the teachers' beliefs, attitudes, and concerns towards one-to one computing? 3) what support do the teachers need during the adoption phase of the computing initiative? As regards the first research question, it was seen that two factors impacted the teacher's prior experiences to the computing initiative: the schools technology infrastructure prior to the one-to-one computing program, and teacher's prior technology integration experiences. From the teacher responses, it can be concluded that the schools did offer some exposure to technological facilities prior to one-to-one computing, though the level of the technology resources differed among these schools. Overall, the teachers volunteers from the selected Early College High Schools considered their schools to be "technologically advanced" compared to other high schools. The access to technological resources like Computers On Wheels and other resources like projectors, TVs, VCRs, and calculators in these schools prior to one-to-one computing had enabled the participant teachers to have some experience in using technology for administrative and instructional purposes, that would stand to their advantage in implementing the one-to-one computing program. Also, the participant's prior exposure to using computers and various other technologies can be seen to act as a precursor to the study participant's increasing interest in integrating technology into their instruction.

With respect to research question two, the transcripts revealed information on the participant teachers' attitudes and beliefs towards the one-to-one computing initiative. It can be concluded that overall, the teachers interviewed had a positive attitude towards the computing initiative and its impact on students, though the pedagogical beliefs differed among the teachers. Teaching style of some teachers was teacher-centric, while some were student-centric; some teachers were seen to view laptops as merely a replacement for paper and pencil, whereas others were eager to find creative ways of using technology to engage students into "active learning." Moreover, a number of teacher concerns surfaced related to hardware and software support, professional development, classroom management, communication, and resources.

Finally, the researcher narrowed down the key support areas identified by the responding teachers as recommendations for addressing their concerns pertaining to the laptop program. The key areas of teacher needs identified by the participants were: adequate communication regarding the laptop program, need-specific professional development, technology and curriculum-related support, infrastructure support, and personal needs like time for professional development and program implementation, and compensation for extended hours of work and performance related anxieties.

CHAPTER 5

CONCLUSIONS, DISCUSSION, IMPLICATIONS, RECOMMENDATIONS

This qualitative study was designed to understand the beliefs, attitudes, and concerns of teachers during the early implementation or adoption phase of one-to-one computing in Early College High Schools. This study has provided insights into how the participating teachers in the selected Early College High Schools are experiencing the adoption of ubiquitous computing, and the support these teachers need in order that their concerns and needs are met and for them to be able to effectively implement technology.

Chapter four presents an overview of findings and participant responses received by the researcher. This chapter will discuss the findings from this study and their relation to the existing body of literature. This chapter also presents the key themes that inform the purpose of the study, which is to understand the concerns that Early College High School teachers have during the early adoption phase of the laptop initiative, and the support that the teachers need to effectively implement the laptop initiative and integrate technology into their curriculum.

In analyzing data across categories, it was interesting to note that the common themes that emerged related to teacher's experiences during the early implementation of one-to-one initiative are consistent with the basic assumption of the Concerns-Based Adoption Model, which states that that change is a process not an event. As has been confirmed by past research, different teachers were found to be at different stages of concerns, and it can be concluded that teachers typically progress through a predictable sequence of Stages of Concern as they become involved in using or implementing any innovation. The qualitative investigations based on the Concerns-Based Adoption Model informed us that teachers had concerns that changed over time. Some participating teachers expressed concerns in the area of "self". These teachers had

concerns such as lack of adequate information regarding the laptop program, the need for more knowledge, and other personal concerns like anxiety about their performance, which may get affected by the laptop program. Other teachers who had been using technology for years, and were slightly ahead in terms of technology integration, expressed concerns at the "task" level. Their concerns were centered on their effective integration of technology, and time to explore and master new software for their classes. The researcher did not find any concerns regarding the "impact" the program would have on the students. This may be consistent with past literature that suggests that only when teachers resolve the self and task concerns, do they reach the stage of "impact" concerns (Fuller, 1969; Hall, George & Rutherford, 1979; Hall & Hord, 1987; Hall & Hord, 2001).

Table 7: Example of Stages of Teacher Concerns Identified

Concerns	Stage of Concern
I do have concerns about test scores	Self
When you tend to have all this new stuff thrown at you it's hard to really understand and learn one thing really great when you're trying to learn four or five things	Self
It's going to take a lot of time, but it's also going to take a lot of manpower and training	Task
My first concern was what happens when the computer starts breaking?	Task
The larger concern that I have is making sure the technology is functioning the way we expect it to	Task

The key themes that emerge out of the study are as follows:

Findings 1: Communication

As seen in chapter four, not many participating teachers confirmed that they were aware of their school's vision of implementing the laptop program. It seems that critical information regarding the vision and goals of the laptop initiative may not have been communicated formally from the school authorities, although the teachers did share their own understanding of how the laptops would be beneficial for their schools. This initial introduction is believed to be an integral stage in the progression toward any educational innovation, and the teachers must be communicated the school's vision of implementing the laptop program and accordingly ways for students to learn with laptops (Zucker, 2005). Zucker further explains that it is important to align the laptop program with key school and state goals. For example, a school must decide on the goals that are important for them, whether it is increased motivation, better writing skills, technology proficiency, more critical thinking and reasoning. Taking Maine's example, in response to needs identified by the state department of education, Maine chose to implement a professional development program to help rural middle schools improve the teaching of mathematics using the laptops.

Another lack of communication was regarding policies and procedures attached to the laptop program. Comments like "it was excitement at first and then disappointment, because of lack of information" can become a barrier to the adoption of initiative.

Research has indicated that communicating goals for a wireless initiative is critical, and creating committees, task forces, and councils can help provide leadership for communication strategies (Center for Digital Education, 2005).

Finding 2: Attitudes

According to Simpson, Koballa, Oliver, and Crawley (1994), attitudes can be defined as specific feelings that indicate whether a person likes or dislikes something. In the context of technology integration, teacher attitudes toward technology may be conceptualized as teachers liking or disliking the use of technology. The results of this study show that the majority of the responding teachers have highly positive attitudes regarding usefulness of technology and the impact of the laptop program on students. Also, these teachers already have background knowledge in using computers for word processing, spreadsheets, and email.

This is consistent with the findings from initial evaluations of Maine and Berkshire. Fairman (2004) documented that the teachers felt laptops enhanced student motivation, and teachers experienced positive changes in their classrooms as a result of the laptop program. The participating teachers also felt that the laptops allowed them to be more easily adapted in the classroom, and increased their opportunity to act spontaneously. Another major change in attitude was observed in the MLTI teachers with regards to their role as a teacher, to becoming "learners" of technology (Fairman, 2004, p.5). The limited time for training prior to implementation effectively forced many teachers in Maine, who did not feel completely proficient with computer technology, to accept help from many sources in the school, even from students. Similar to the findings from MLTI, the participating teachers in the Early College High Schools see their changing roles as "learners of technology," and that they looked up to students for technical support. The Berkshire evaluation did not find any statistically significant differences between the pre and post survey administrations, indicating that teacher beliefs and attitudes shifted little as a result of their experience in one-to-one classrooms.

According to Wong (2002), although teachers are equipped with knowledge and skills in using computers, the success of implementing the new curriculum with information technology in education depends greatly upon the attitudes of the teachers and their willingness to embrace such technology. Therefore, teachers should possess not only computer knowledge and skills, but they must also have the right attitudes towards technology. This is important because it has been found that teachers' attitudes toward technology have a marked influence on their readiness to utilize technology in their teaching strategies (Office of Technology Assessment, 1988). Further, Gressard & Loyd (1985) established that perceptions of the potential usefulness of computers could also influence an individual's attitudes toward computers. In other words, if teachers have confidence in using the technology, they will possess positive attitudes, which may greatly influence their teaching and learning process. However, if teachers are reluctant to use computers, then changing teachers' attitudes could possibly be one way of overcoming this problem. Thus, the successful use and application of computers in the educational system may very much be related to, and dependent upon, the teachers' attitudes toward technology.

Findings 3: Beliefs

Teachers' beliefs for this study are defined as their educational beliefs about teaching and learning (i.e., pedagogical beliefs), and their beliefs about technology (Ertmer, 2005; Windschitl & Sahl, 2002). The responses received during this study reveal that overall, the responding teachers believed that the "students will be better engaged with computers," and will enable students to become "active learners." While some teachers were excited on the prospect of their students doing research, participating in interactive and collaborative multimedia like moodles and wikis for higher order thinking; and creating web pages, there were some who feared that laptops would end up being a "new toy" for the students. Also, one teacher mentioned the use of

laptops as "to have my notes and all my worksheets and extra activities, projects, all on my WebPages." It is clearly evident that different teachers carried different beliefs about how to use technology in classrooms. There were those who looked forward to developing learner-centered lessons, and there were also teachers who were looking at technology for activities that were essentially only ways that replicated their current teaching practices. This observation is consistent with the literature that teachers who already follow constructivist principles have less difficulty using technology in learner-centered activities (Fulton, 1999; Mehlinger, 1995). Past research in laptop programs has shown that teachers' beliefs about students, the potential role of technology in learning, and the availability of high-quality digital content influence the degree to which they use laptops with students (Lane, 2003; Trimmel & Bachmann, 2004; Windschitl & Sahl, 2002). Those teachers who believe that there are adequate software and Internet-based resources available to help teach their particular content area may use laptops with students more often than teachers who believe that there are simply not enough high-quality materials available (Lane, 2003; Trimmel & Bachmann, 2004). Conversely, those teachers who are concerned that students will use their laptops for unauthorized purposes, such as playing games or searching the Internet for recreational purposes during class time, are likely to report implementing laptops less often with students in class (Jaillet, 2004; Trimmel & Bachmann, 2004; Zucker & McGhee, 2005).

Findings 4: Technology Integration

As for the technology availability at these schools prior to the laptop program, it can be concluded that all participating teachers reported that they used computers daily in their classrooms, both for their own use and for imparting instruction. These schools were "technology friendly," with a range of technological resources available to the teachers like

Computers on Wheels, LCD projectors, smart boards, and wireless Internet access. The schools had some or all of the mentioned technology available to the teachers. Though the levels of technology usage ranged from low to moderate, it seems that the availability and access to various technological resources has served as a catalyst to the teacher's increasing interest in integrating technology into their instruction. Comparing this finding with the existing literature, in reviewing the frequency of teacher technology use in technology-abundant high schools, it has been observed that creating abundant access to technology would not necessarily lead to an increased level of technology use in the classroom (Cuban, Kirkpatrick, & Peck, 2001). While technology availability is certainly a requirement, it is but an initial step. Research by Cuban et al. show that even in better than average technology-rich schools, teachers were still not integrating technology to any substantial degree. Studies have stated that there could be barriers that are specific to a particular teacher that may be impeding the technology integration. It is thus seen that providing access to technology is not sufficient to ensure its use by teachers. Further, Ertmer (1999) stated that teachers would not automatically integrate technology into teaching and learning even if barriers such as access, time, and technical support were removed. Regardless, the study of barriers as they pertain to technology integration is essential because this knowledge could provide guidance for ways to enhance technology integration. Some of the barriers preventing teachers from integrating technology as revealed by this study are lack of communication, lack of information and knowledge regarding the computing initiative, absence of timely technical and curriculum support, lack of time, lack of confidence, professional development not targeted to the teacher needs, and hardware malfunctions. In Texas, data from classroom observations and fieldwork also suggest that in the initial stages of implementation, most teachers maintained their existing pedagogical practices. Teachers typically had students

use laptops to do the same kinds of activities they previously had completed with paper and pencil, such as completing worksheets, typing vocabulary words and definitions, or reviewing for multiple-choice tests. This finding is consistent with research showing that teachers progress through developmental stages while learning to create technology-infused classroom environments (Evaluation of the Texas Technology Immersion Pilot, 2006).

Findings 5: Teacher concerns

While the participating teachers were excited about the one-to-one laptop initiative overall, there were a number of underlying issues that surfaced from their responses. The major categories of concerns that emerged, and as identified in chapter four are:

1. Support Related Concerns (for technical, curriculum, infrastructure, supplemental resources, and teacher deliverables)
2. Classroom Management Related Concerns
3. Professional Development Related Concerns (Technical skills, curriculum specific standards of technology integration, continued teacher-specific professional development)
4. Communication Related Concerns (Program vision and goals; policies, procedures and protocols)
5. Personal Anxieties and Performance Related Concerns (Time, Self performance, Preparing back up lesson plans, and Student test scores)

Compared with findings from past one-to-one initiatives, similar concerns were reported by initial evaluations in MLTI and Berkshire. Most of the teacher concerns revolved around technical problems and the lack of, or limited technical support; many teachers experienced trouble staying connected to the network, and sometimes the computers performed slowly due to

the amount of online traffic at any one time. MLTI teachers expressed concerns with respect to the slow network, difficulty accessing on-line materials, and timeliness of technical support, that may be impeding the full benefits of the initiative (Bebell & Russel, 2006). Berkshire also reported similar teacher concerns with respect to infrastructure and support. Teachers expressed concerns with time-consuming searches for appropriate instructional resources on line, with student adherence to the laptop policies, and student misuse of computers. Also, similar to this study, concerns were also raised on having to create dual materials for students with laptops and also for those who for whatever reasons did not have their laptops. Readily available technical support was also found to be a critical must-have for laptop programs to succeed. In addition to the technical concerns, teachers reported the need for more time and professional development, which included time to explore and learn how to use the technology, and professional development activities designed to help them integrate the technology more extensively in their curriculum development and instruction.

Another similarity is seen in Berkshire report, which states that the greatest barriers to implementation involved people. Teachers were at different stages of readiness for immersion and their receptivity varied. Varying abilities and attitudes, coupled with teachers' perceived pressures to improve students' scores on the TAKS, made many teachers reluctant to try new and untested instructional methods and materials in the first year. In Texas, a major challenge for teachers in the first year was simultaneously learning how to use technology and finding time to integrate laptops and digital resources into existing practices. It was found that decisions about how and the frequency of laptop usage for teaching and learning depended on each teacher's readiness and preference.

Findings 6: Support Needed

Based on the analysis of teacher concerns, as well as from the responding teachers' description of what support they needed during the initial phase of adoption of the laptop program, it was concluded that support was needed in the following areas: 1) communication, 2) professional development, 3) technology-related support, 4) curriculum-related support, 5) infrastructure, and 6) personal-related support (e.g. time and compensation, performance anxiety).

Consistent with past research findings, professional development is a critical component for implementation of any educational innovation (Penuel, 2006). The results of this study highlight the importance of designing targeted professional development. Research has suggested that no plan, however well conceived, will be of any value if it is not implemented at the "building and classroom levels" (November, Staudt, Costello, & Huske, 1998, p. 12), and it is therefore important to customize the professional development as per the needs of the school as well as the teachers. The findings also support previous research on teacher technology education as it suggests that teachers who use technology in their classrooms are often those teachers who had prior experience with technology; that lack of time, support, and resources can act as barriers in the implementation process. Studies have shown that teachers' computer use is affected by their perception of the usefulness of technology for teaching, and overcoming technology-related anxiety (Knezek, Chiristensen, & Rice, 1996), and appropriate professional development can positively affect teachers' attitudes towards computers (Reed, Anderson, Ervin, and Oughton, 1995) by giving them confidence that technology is a valuable tool, and showing models of effective technology integration. Another aspect of professional development needed is assistance in curriculum planning. For example, in Maine, content specialists were assigned to

help teachers with finding digital resources and integrating technology into specific content areas (Silvernail & Harris, 2003). Some programs have assigned staff (either internal to the school or external) to help teachers on an as-needed basis with technology integration (Davies, 2004; Dinnocenti, 2002; Fairman, 2004; Light et al., 2002). One of the core components for any school interested in integrating technology would be to have people whose job it is to train teachers in the use of the technology for their respective curriculums. No such person existed at any of the selected schools. The responding teachers had no one to turn to for basic software support or professional development. It is very evident as to why teachers would feel that there is a lack of support, and that they are not being supported, guided, or rewarded in their attempt to integrate technology into their teaching.

In addition to professional development, readily available technical support also appears to be important for laptop programs to succeed. Teachers across programs often mention the lack of sufficient onsite technical support. Programs in which teachers report a high degree of reliability for laptops often have technical support staff devoted to helping with the program and ready access to outside vendors for major problems (Hill & Reeves, 2004). Past studies have also confirmed that ensuring all students' laptops are working makes it less likely that teachers will have to develop two sets of assignments—one for students with laptops and another for students without laptops (Davis et al., 2005; Gaynor & Fraser, 2003; Zucker & McGhee, 2005). Several studies support the value of onsite technical staff dedicated to technology integration and teacher support (Becker, 1994; Evans-Andris, 1995; Fullan & Stiegelbauer, 1991; Milken, 1998; National Center for Education Statistics [NCES], 2000). The lack of onsite assistance is seen to directly impact their ability to use technology without additional support. In addition, Zucker (2005) stated:

> A critical factor for the effective implementation of one-to-one computing is the existence and maintenance of a high-quality network infrastructure. Schools may require network infrastructure modifications, which can be costly and time-consuming. If these issues are addressed at the onset, significant time and trouble may be saved later. Setting up the necessary infrastructure is not sufficient; it is also necessary to maintain it.

The data also reveal that teachers believe there is not enough communication regarding various aspects of the laptop program, such as the goals and vision of the laptop program and information regarding policies pertaining to student use of laptops, storage, charging of laptops, loss and damage, and also the knowledge of whom to contact for what issues, problems, or support. Also, the comments of the teachers do reflect that there had been no formal communication to the stakeholders on how the laptop program would help in shaping the 21st century classrooms, and how the teachers can use technology to improve academic achievement in their respective subject areas. Though the teachers had their personal perceptions about the laptop program, there wasn't any shared vision. Past literature has shown that when all stakeholders (teachers, administrators, students, parents, and technicians) are well informed about the project and collaborate with one another, emerging problems are more easily identified and can be addressed at an early stage (Zucker, 2005). Research indicates that school authorities are highly influential participants who can drive the vision for one-to-one technology (Center for Digital Education, 2005). Zucker (2005) emphasized that communicating goals for a wireless initiative is critical, and effective communication can be created through committees or task forces that would be responsible for providing leadership for communication strategies. It is critical to reflect on the school primary goals and what will be needed to achieve them. For example, depending upon which goals for students are most important, schools can license

appropriate software and provide focused teacher professional development, select new curriculum, or develop new assessments.

The following figure depicts the alignment of participant recommendations for support strategies with past literature. This figure builds on figure 3, which depicts the support strategies recommended by study participants for teacher concerns identified:

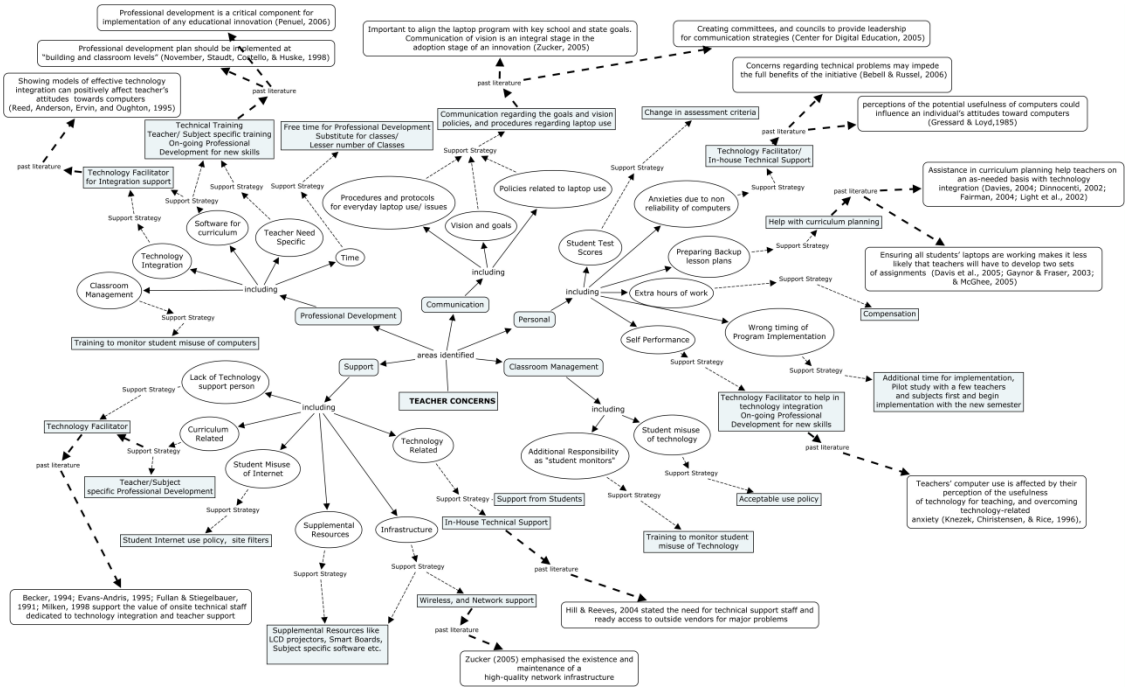

Figure 4: Alignment of Participant Recommendations for Support Strategies with Past Literature

Limitations

The length of the study could have generated results that were specific to the initial phase of adoption and may not exist as the teachers progress into the initiative. A study spread over a longer time span would be warranted to investigate whether teacher concerns were consistent with the concerns based adoption model, which was the theoretical basis of this study. However, it would be beneficial to gauge teacher concerns and needs within regular phases of time to

determine if there are any concerns that need to be addressed to ensure that it does not impede the program implementation.

Another major limitation of this study is the small sample size. Though the teacher's were willing to participate and share their experiences regarding the laptop initiative, their "work pressure" generally did not allow them to provide the researcher any time for an interview. The teachers expressed that they were "overwhelmed" with all the other evaluations that they were being asked to participate in. Some principals also expressed reluctance for their teachers to participate in a small study with so many bigger evaluations occurring simultaneously with the researcher's study.

Member checks were not conducted for this study because the teachers were reluctant respondents with little time to participate in the researcher's study, as they were already involved in the larger evaluations that were being conducted simultaneously with this study. The researcher was initially invited to participate in a larger evaluation by the organization charged with evaluating the NC one-to-one pilot in Early College High Schools, but since that project took longer than expected to get started, the researcher was advised by her committee to seek data on her own after it was apparent the organization's project would not accommodate either her data collection needs or timeline. Several months of working on the organization's project, therefore, significantly delayed data collection and contributed to a smaller sample size than originally anticipated when the researcher was told erroneously she would be able to utilize data from the larger evaluation project.

Implications for Practice

This study has highlighted professional development for teachers as critical for the adoption process. Policymakers and school administrators historically have been known to make

decisions and to direct change processes without considering the concerns of the teachers who are going to be affected by the change. Research shows that there is a widespread disagreement among educators and policymakers as what should constitute effective professional development (Vaughan, 2002). Policy makers have not been considering the requirements of teachers while planning professional development. As revealed by this study, it is important for the success of any intervention that the concerns of those engaged in the change process are taken into account for formulating professional development. Furthermore, it is important to evaluate the initial phases of the adoption process, as teachers are more likely to adopt and implement an innovation if their needs and concerns are met during the initial phases.

Moreover, there is a need for restructuring professional development to fit teacher and school-specific needs. Teacher professional development can be the largest cost in implementing effective one-to-one computing, so its goals and strategies must be carefully planned in advance. The restructuring of professional development is required to address school-specific needs, which includes the teacher-specific needs as well as the core curriculum technology standards.

Developing a communications plan is another important action item, as it will greatly benefit the transition to one-to-one computing. Teachers, students, and parents should be informed of all stages of planning and implementation. For example, it is recommended that school leaders communicate the vision and goals for the laptop program, and also let the teachers know as to what is expected from them in terms of technology integration in their respected subject areas. The stakeholders also need to be informed of the policies and procedures related to laptop use.

Finally, evaluative research should be an integral part of any one-to-one program (Zucker, 2005), informing policymakers about the implementation of their plans, documenting

impacts of the program, and getting feedback from the stakeholders. By providing formative feedback on implementation and impacts of the one-to-one laptop program, research can provide decision makers with ongoing useful information that can be used to inform professional development interventions, and support initiatives as per the needs identified.

Recommendations for Future Research

Based on the findings of this study, the following recommendations have been proposed that merit further research:

It would be valuable to narrow down research to the most critical components, and measure them at different levels, for example it is most important to focus on the goals" of a laptop program for a school, and focus on how different stages of implementation fare with respect to the goals. As observed in this study, the teachers were not aware of the school's vision and goals for implementing the one-to-one computing program. It therefore is important to align the laptop program with the key goals, and all support interventions such as professional development, and decisions regarding procurement of specific hardware and software should follow based on what the key goals are. Thus, there is a need for research that evaluates how planning for a computing program is carried out, keeping the "goals" in perspective. According to the researcher, it is important to study the process of planning and implementation before measuring the impact of a program.

The findings of this study revealed that teachers were not aware of the state's standards for technology integration with respect to their subjects. It has been observed that professional development and teacher beliefs are two critical components for the success of any computing initiative. Teacher professional development can be the largest cost in implementing effective one-to-one computing, so its goals and strategies must be carefully planned in advance. The

restructuring of professional development is required to address school-specific needs, as well as the state directives, which include the core curriculum technology standards. It therefore becomes important that professional development is aligned to the state's directives on subject-specific technology integration, and research be carried out to evaluate the professional development and other support measures offered by schools with respect to these directives.

As seen in this study, teacher concerns can impact the implementation of an educational innovation. It would also be worthwhile to conduct a research synthesis on possible teacher concerns at different stages of implementation, as well as suggestions for support interventions. Such a study can provide direction to new ventures in formulating strategies for implementations and professional development at each stage.

Finally, research is needed on successful one-to-one program implementation models that would document examples of successful implementation models of past one-to-one computing programs. This could be helpful in providing direction to future ventures as well as prevent wastage of time, money, manpower, and resources that take place as a result of poor planning and faulty implementations.

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APPENDICES

Appendix A

Recruitment Letter

Hello, my name is Jyoti Soorma, and I am a Masters student at North Carolina State University. I am currently recruiting participants for a research study to understand the beliefs, attitudes and concerns of Early College High School Teachers towards one-to-one computing, and the use of computers in classrooms during the adoption phase of the one-to-one computing initiative. Voluntary participants will be recruited from schools that have implemented the one-to-one computing initiative, and the participant should have been actively involved in the implementation of the computing initiative. This study is for the purpose of my Master's Thesis. This study is separate from the Friday Institute Evaluation.

As a part of the study, volunteers will agree to be audiotaped in a one-to-one interview. They may be asked to participate in a follow up focus group discussion at a later date, which will also be audiotaped, and be asked to review the written transcript of the interview for verification purposes.

All information will be kept strictly confidential and participants will not be identified by name. The total time required will be approximately 30-45 minutes for each interview, and 60-90 minutes for the focus group.

The knowledge gained from this study will hopefully help the participants and the school in better addressing the needs of teachers with respect to integration of technology in classrooms.

I sincerely hope that you will choose to participate in this study. If you would like to participate, please email me at soorma_jyoti@yahoo.com. Should you have any questions or concerns, please email me and I will be happy to answer your questions.

Sincerely,

Jyoti Soorma

Appendix B

Informed Consent Form for Research

Title of Study: Teacher concerns and attitudes during the adoption phase of one-to-one computing in Learn & Earn schools.

Principal Investigator Jyoti Soorma Faculty Sponsor (if applicable): Dr. Kevin Oliver

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You are being asked to participate in a research study. The purpose of this study is to understand the beliefs, attitudes and concerns of teachers towards one-to-one computing, and the use of computers in classrooms during the adoption phase of the one-to-one computing initiative. The study would describe the teachers' beliefs, attitudes, and concerns and their implications for practice. This study is separate from the Friday Institute Evaluation.

INFORMATION

If you agree to participate in this study, you will be asked to participate in a semi-structured audiotaped interview of about 30 minutes with the principal investigator, Participants will also be asked to review the written transcript of the initial interview for verification purposes.

RISKS

You will be asked to talk about your views about the adoption phase of the one-to-one computing initiative at your school, and there may be some information or experiences that you may not be comfortable sharing. Other than that, there is no anticipated physical or mental risk to the participant. Subjects are free to skip any question that makes them uncomfortable.

BENEFITS

The knowledge gained from this study will hopefully help you in better addressing the needs of teachers with respect to successful integration of technology in classrooms.

CONFIDENTIALITY

The information in the study records will be kept strictly confidential. Data will be stored securely in the researcher's storage. The audio-tapes will be coded rather than bear the participant's name, and the tapes will be locked in storage by the researcher. The audiotapes will be destroyed at the end of the study.

No reference will be made in oral or written reports that could link you to the study.

CONTACT

If you have questions at any time about the study or the procedures, you may contact the researcher, Jyoti Soorma, at 919-244-0819. Or, you may contact my advisor, Dr. Kevin Oliver at 602, Poe Hall, North Carolina State University or 919-515-1772. If you feel you have not been treated according to the descriptions in this form, or your rights as a participant in research have been violated during the course of this project, you may contact Dr. David Kaber, Chair of the NCSU IRB for the Use of Human Subjects in Research Committee, Box 7514, NCSU Campus (919/515-3086) or Mr. Matthew Ronning, Assistant Vice Chancellor, Research Administration, Box 7514, NCSU Campus (919/513-2148)

PARTICIPATION

Your participation in this study is voluntary; you may decline to participate without penalty. If you decide to participate, you may withdraw from the study at any time without penalty and without loss of benefits to which you are otherwise entitled. If you withdraw from the study before data collection is completed your data will be returned to you or destroyed at your request.

CONSENT

"I have read and understand the above information. I have received a copy of this form. I agree to participate in this study with the understanding that I may withdraw at any time."

Subject's signature_____
Date _____

Investigator's signature_____
Date _____

Appendix C

Section 1: Demographic Form

Please answer the following questions as applicable to you:

Your responses are anonymous and will not be associated with your name in any way.

1. In which of the following subject areas do you teach?
Language Arts _____
Math/Algebra _____
Science _____
Social Studies _____
Foreign Language _____
Other _____

2. What grade level do you teach?
6 _____
7 _____
8 _____
Other _____

3. How many years of teaching experience do you have?
1-2 _____
3-5 _____
6-10 _____
11-15 _____
16 or more _____

4. How many years have you worked in this school?
Less than a year
1-3 years _____
4-5 years _____
6-10 years _____
More than 10 years _____

5. Your certification area is:
Elementary education_____
Middle school education_____
Secondary education_____
Special education_____
Other. Please Specify_____

6. Your age is:
21-25_____
26-30_____

31-35_____
36-40_____
41-45_____
46-60_____
61 or older_____

7. Please select your gender:
Male _____
Female _____

8. Do you have a computer at home?
Yes_____
No_____

9. How often do you use a computer?
Daily_____
Once a week_____
Once a month_____
Never_____

Have you ever received any type of computer training?
Yes_____
No_____

11. Where did you receive the computer training?
Self-taught_____
School_____
Computer Store_____
Other. Specify_____

Appendix D

Teacher Interview Guide

Research Topic

Teacher concerns and attitudes during the adoption phase of one-to-one computing in Early College High Schools.

Introduction

Hello, I am Jyoti Soorma, and am glad that you have decided to participate in this research project to examine the beliefs, attitudes and concerns of teachers towards one-to- one computing, and the factors that influence the same. Your participation in this study is totally voluntary. Your name will not be used in any of the documents or final report and your responses will be confidential. If you would like to stop your participation at any time, you just need to let me know.

As we have discussed, this interview will necessitate about 30-45 minutes of your time. You will participate in a semi-structured, taped- recorded discussion in a few moments. Do you have any questions or concerns at this time?

Here is the written consent form that I would like for you to read and sign for your participation in the study giving me the permission to tape our interview for accuracy.

Interview Questions

Opening question

1. Are you aware of the school's vision for the 1:1 computing initiative?

2. What do you see as your schools vision for this project?

Teacher attitude towards one-to one computing:

1. What is your perception of one-to one computing?
    a) Are you excited about this computing initiative?
2. How do you think laptops will impact students?
3. How do you think laptops will impact your classroom and teaching?
4. How have parents of your students reacted to the laptop program?
5. What technology do you have access to currently in your classrooms?
6. Please describe what technology did you use in your classrooms for instruction or everyday administrative and planning work, before the introduction of 1:1 computing?
7. Please provide any example of how you would like to incorporate technology in your classroom.
8. What are your apprehensions and concerns regarding integrating technology into classrooms?

Professional Development and skill level of teachers

I would now like to ask you a few questions about the development programs that were offered to the teachers.

1. What types of formal and non-formal professional development activities have you participated in, related to the laptop program?
2. How effective have the professional development activities been?
3. In what ways does your administration support you in implementing learning and teaching with technology?
4. What policies are in place to help with the implementation?

5. What kinds of formal and non-formal training/workshops/support would you like to see offered in the future?
6. What in your opinion are your training needs with respect to the laptop program?
7. How would you like your training needs to be addressed?
8. What changes have you seen in your attitude towards 1:1 computing since the initiative was introduced? What do you think contributed to this change?

Closing question

1. Is there anything else that you would like to share about the laptop initiative and the teacher concerns, that we missed talking about?
2. Thank the participant for participating in the interview.

Appendix E

Teachers' Focus Group Interview Guide

Research Topic

Teacher concerns and attitudes during the adoption phase of one-to-one computing in 'Learn & Earn' schools.

Introduction

Hello, I am Jyoti Soorma, and am glad that you have decided to participate in this research project to examine the beliefs, attitudes and concerns of teachers towards one-to- one computing, and the factors that influence the same. Your participation in this study is totally voluntary. Your name will not be used in any of the documents or final report and your responses will be confidential. If you would like to stop your participation at any time, you just need to let me know.

As we have discussed, this focus group discussion will necessitate about 60-90 minutes of your time. You will participate in a semi-structured, taped- recorded discussion in a few moments. Do you have any questions or concerns at this time?

Here is the written consent form that I would like for you all to read and sign for your participation in the study giving me the permission to tape our interview for accuracy.

Interview Questions

1. What are your perceptions about the computing initiative?
2. How well do you feel prepared for this program?
3. What are your concerns with respect to the laptop program at this stage?
4. How can the school administration best address these concerns?

5. What support do the teachers need during the implementation phase of the computing initiative?
6. What kinds of formal and non-formal training/workshops/support would you like to see offered in the future?