IDENTIFICATION OF PREDICTORS OF EDUCATORS'

TECHNOLOGY IMPLEMENTATION

by

LISA LEMOINE

(Under the Direction of Elaine Adams)

ABSTRACT

New national reform movements and state-driven policies and standards have resulted in an increased demand for professional development at the local level, specifically in technology use. Based on new national reform movements, states have assumed the leadership role establishing new academic standards, teacher certification requirements, technology standards for teachers and students, and technology standards for teacher preparation programs. States also have been the driving force behind the development of state technology plans, goals, and reform movements aimed at aligning the states with federal programs and objectives (U.S. Department of Education, 2006; Zucker, Dove, & McGee, 2000).

Many states, including Georgia, have put into place training reform programs in technology for educators to improve technology competencies (Burke, 2000; Georgia Legislature, 2000; Kentucky Department of Education, 2006; South Carolina Department of Education, 2006; Texas Education Agency, 2004; Virginia Department of Education, 2006).

The purpose of this correlational study was to analyze the characteristics of educators in a large public school district in the state of Georgia to provide predictors of Personal Computer Use (PCU), Current Instructional Practices (CIP), Level of Technology Implementation (LoTi), and Level of Technology Implementation (LoTi) total score as measured by the Level of Technology Implementation Questionnaire (LoTiQ). Five independent variables were included in this study: method of completing the technology requirement for recertification, certification field, grade level, age, and gender. A random sample was taken of all certified teacher employed during the 2006-2007 school year of this large public school district in the state of Georgia. Knowledge of the self-perceived implementation levels was measured by the Level of Technology Implementation Questionnaire (LoTiQ) (F. Saunders, personal communication, October 13, 2006). Stepwise multiple regression was used for analysis. Based on the stepwise multiple regression and a follow-up linear regression, significance was found between the independent variables method of completing the technology requirement for recertification, grade level, and age and the dependent variable PCU. Significance was also found between the independent variable grade level and the dependent variable LoTi. A correlation matrix further examined and confirmed the relationships found.

INDEX WORDS: Technology-professional development, Level of Technology Implementation, LoTi, Diffusion of Innovations, Concerns Based Adoption Model, Georgia, Technology Implementation

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DEDICATION

I would like to dedicate this dissertation to my family.

To my husband, Pete LeMoine, I want to express my love and appreciation. Thank you for supporting me every step of the way. You always had confidence in me achieving this goal even when I did not.

To my parents, Ginger and Dennis Weeks, you invested so much of your time and energy allowing me the opportunity to complete this degree. I am forever grateful for your love and support.

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CHAPTER 1

INTRODUCTION

Changes in educational standards are resulting in the need for teachers with higher skill levels (Ambach, 1996; Darling-Hammond, 1997). Twentieth-century teaching methods are no longer effectively meeting the needs of 21st century students (Ambach). Rather than requiring schools to improve on what they are already doing, the focus now is on changing the structure of teaching and learning in schools along with the structure of school organizations (Ambach). Rather than increasing the number of tests given or courses required, the foundation of teaching such as teacher education programs, instructional methods, and the goals and activities of instruction must be reshaped (Darling-Hammond).

According to Darling-Hammond (1997), to progress from isolated efforts to a revitalized educational system, promising initiatives that include a logical set of policies linked to educational goals must be supported by a teacher development system. Critical to a teacher development system is the redesign of teacher education and professional development. Teacher education and professional development programs should be catered around standards for student learning and for excellence in teaching practice (Darling-Hammond; Hamsa, 1998; Wise, 1996). One strategy for creating a greater cohesiveness between theory and practice is the development of technological skills that support student and teacher learning in the information age (Darling-Hammond; Zucker, Dove, & McGee, 2000).

In 1984, the Southern Regional Education Board (SREB) (Cornett, 1984) published its report, "Computers in Education: Implications for Schools and Colleges." Within that report, a concern regarding teacher preparation and standards for using technology was voiced (Burke, 1998). Based on that concern, several states began to require courses in computer literacy for teacher certification ("Capacity to Use Technology," 2005; Loschert, 2003). In 1989, the International Society for Technology in Education (ISTE), a professional organization of teachers who use technology, formed a committee to address the need for technology training standards (Burke; isteNETS, 2005). At first, these standards focused on teachers of subjects such as business communications or drafting. Later, standards were developed that could be applied towards all teacher programs. After fall 1998, all teacher education programs applying for accreditation with the National Council for the Accreditation of Teacher Education (NCATE) were required to meet the teacher technology standards identified by the ISTE (Burke; Zucker et al., 2000).

New national reform movements and state-driven policies and standards have resulted in an increased demand for professional development at the local level specifically in technology use. Based on new national reform movements, states have assumed the leadership role establishing new academic standards, teacher certification requirements, technology standards for teachers and students, and technology standards for teacher preparation programs (Zucker et al., 2000). States have also been the driving force behind the development of state technology plans, goals, and reform movements aimed at aligning the states with federal programs and objectives (U.S. Department of Education, 2006; Zucker et al.).

In Georgia, the A Plus Education Reform Act of 2000, House Bill 1187, was signed into law by Governor Roy Barnes in 2000 (Georgia Legislature, 2000). One requirement of the A Plus Education Reform Act of 2000, HB1187, was that all certified personnel must meet a special technology requirement for recertification. According to the Professional Standards

Commission (PSC) (2006), the governing body administering this requirement, all certificated personnel must complete this technology requirement by July 1, 2006. Certified personnel can meet this requirement by completing one of four options: a) National Board Certification or possessing a lifetime certificate, b) the InTech Professional Development course, c) a PSC approved course offered by a RESA, college or university, or other agency, or d) a PSC approved course included in an undergraduate or graduate school program or study (Gwinnett County Public Schools [GCPS], 2006b).

An educator within a large public school system in Georgia met the technology requirement for recertification set forth by HB1187 through National Board or lifetime certification, completion of InTech, or the completion a PSC approved college course or education program (Georgia Legislature, 2000). There were three options to choose from at the local public school system level approved by the PSC (GCPS, 2001). The first option was to complete a test out. This option required the educator to sign a letter confirming his/her technology knowledge and skills and then independently completing an electronic portfolio meeting specified criteria. In addition, the educator was evaluated by his/her local school evaluating supervisor regarding on-the-job technology integration performance (GCPS).

The second option was to complete the Instructional Technology for Teachers (ITT) technology-professional development course. Instructional Technology for Teachers was a 50 hour technology-professional development program exclusive to this Georgia public school system that assisted teachers in meeting the technology requirement for recertification as stated in Georgia HB1187 (GCPS, 2006b). Course participants completed an electronic portfolio in addition to receiving an on-the-job technology integration performance evaluation by his/her local school evaluating supervisor. The course was offered at different school locations throughout the county and delivered by technology instructors previously approved by the state (GCPS).

The final option was the completion of the Georgia AssessOnline test that was accessed at http://gapsc.riverdeep.net/. This was a proctored test that employees of this school system in Georgia signed up for free of charge. After completing the online test, participants receive a copy of their test score specifying whether they passed or failed (GCPS, 2006b). To assist educators in making the decision of which program to choose, a website was created at http://www.gwinnett.k12.ga.us/gtat/ to provide an overview and general information on the test-out and training course options, forms necessary for either the test-out or course option, and a sample portfolio. A list of training sites and AssessOnline test dates were distributed through E-Mail to all county employees detailing training sites including dates and times (GCPS, 2001).

Factors that impact an educator's level of technology implementation identified in previous studies include: method of completing a technology requirement (Criscione, 2005; Sheumaker, Minor, Fowler, Price, & Zahner, 2001), certification field (as identified in other literature as subject area) (Barron, Kemker, Harmes, & Kalaydjian, 2003; Becker, 2001; Hanks, 2002), grade level (Barron et al.; Becker; Bebell, Russell, & O'Dwyer, 2004; Hanks; McCannon & Crews, 2000), age (Baack & Brown, 1991; Czaja et al., 2006; DeOllos & Morris, 2003; Morris, 1989), and gender (Broos, 2005; Correll, 2001; Craig, 1999; Hargittai & Shafer, 2006; van Braak, Tondeur, & Valcke, 2004). Attempts have been made through previous research studies (Barron et al.; Criscione; Hanks; Johnson, 2006; McCannon & Crews; Middleton & Murray, 1999) to find common variables of teachers regarding their technology implementation. Previous research studies have determined that participation in a technology-professional development program impacted an educator's level of technology implementation.

Sheumaker et al. conducted a study regarding Georgia's InTech program, a constructivist-based technology training program used to meet the technology requirement for recertification. Results of their study indicated that teachers who received technology training in an InTech classroom had higher perceived levels of technology integration than individuals who participated in an InTech redelivery method at the local schools or individuals who received no InTech training. Criscione conducted a study using the LoTiQ to assess technology integration levels of teachers based on participation versus non-participation in Title III Technology Literacy Challenge Fund courses. Results indicated that participation in the Title III Technology Literacy Challenge Fund courses did have an impact on technology implementation in the classroom (Technology Literacy Challenge, 1996).

In the research study of technology in K-12 schools of one of the nation's largest school districts comparisons were made across subject areas (English, mathematics, science, and social studies). Only responses for middles and high school teachers were evaluated with regards to subject area differences. With regards to differences among subject areas, science teachers were the most likely to integrate computers as a research tool (Barron et al., 2003). In a 1998 study conducted by the Center for Research and Information Technology Organizations technology integration within subject areas was examined (Barron et al.). Results of this study concluded that students in self-contained elementary school classes or in technology-related courses in high school were more likely to use technology. According to Forster (2006), mathematics curriculum has been assisted by technology applications that assist in the transformation or translation of information entered by the user.

Previous studies comparing teachers' integration of computers in classrooms across grade levels and subject areas concluded that elementary school teachers were more likely to use computers as a problem-solving or communication tool than middle or high school teachers (Barron et al., 2003; Hanks, 2002). McCannon and Crews (2000) found that elementary technology professional development courses were catered towards administrative tasks such as word processing rather than curriculum integration, presentation software, and research. Bebell et al. (2004) reported that elementary teachers used technology more frequently to accentuate lessons and asked students to use technology more often in the classroom than middle and high school teachers. Middle and high school teachers reported using technology more frequently for grading purposes than elementary teachers (Bebell et al.).

Research has also revealed a connection between age and negative attitudes towards computers (DeOllos & Morris, 2003; Morris, 1989). In a study conducted by Czaja et al. (2006), results indicated that older adults were using technology at an increasing rate. However, older adults had more difficulty than younger adults when learning to use and operate current technologies such as computers and the Internet. Baack and Brown (1991) concluded that the benefits for acquiring new technology skills must be communicated to older adults. Otherwise, older adult users will have little motivation to learn.

Hargittai and Shafer (2006) conducted a study regarding differences in actual and perceived online skills with regards to gender. Results from that study indicated a significant difference with regards to gender and self-perceived skill levels with women possessing a lower degree of self-perceived skill levels. Women were more likely to lack confidence in themselves when it came to self-perception of their online skills (Correll, 2001; Craig, 1999; Hargittai & Shafer). In a study conducted by Broos (2005), males were found to have less computer anxiety than females. Females also experienced more negative attitudes towards computers and the

Internet. van Braak et al. (2004), also concluded from their study that gender did have a significant impact on classroom use of computers with males integrating computers more often.

Technology-professional development goals for the large public school district are presented in their Comprehensive Instructional Technology Plan (GCPS. 2006a) and administered by the Division of Information Management. To support instructional technology use in classrooms, each school in this system has at least one Local School Technology Coordinator (LSTC) on staff. The LSTC is a certified teacher whose primary responsibility is to assist teachers in the integration of curriculum and technology. The LSTC's offer technology-professional development at the local schools based on identified needs of the county and/or local school. Although this large public school system has typically used a train-the-trainers model of technology-professional development, the current Comprehensive Instructional Technology Plan calls for the investigation into other methods of technology-professional development, including the use of online tutorials and class technology training (GCPS). A study that identifies common predictors of educators' level of technology implementation can supply technology-professional development leaders with valuable information for addressing issues related to implementation in their technology-professional development courses.

Purpose of Study

The purpose of this correlational study was to analyze the characteristics of educators in a large public school district in the state of Georgia to provide predictors of Personal Computer Use (PCU), Current Instructional Practices (CIP), Level of Technology Implementation (LoTi), and Level of Technology Implementation (LoTi) total score as measured by the Level of Technology Implementation Questionnaire (LoTiQ). Results of this study may contribute to the development of future technology-professional development programs.

Research Questions

This study will addressed the following research questions:

Research Question One

What combination of method of completing the technology requirement for certification, certification field, grade level teaching assignment, age, and gender provided the best model for predicting educators' Personal Computer Use (PCU) scores?

Research Question Two

What combination of method of completing the technology requirement for certification, certification field, grade level teaching assignment, age, and gender provided the best model for predicting educators' Current Instructional Practices (CIP) scores?

Research Question Three

What combination of method of completing the technology requirement for certification, certification field, grade level teaching assignment, age, and gender provided the best model for predicting educators' Level of Technology Implementation (LoTi) scores?

Research Question Four

What combination of method of completing the technology requirement for certification, certification field, grade level teaching assignment, age, and gender provided the best model for predicting educators' Level of Technology Implementation (LoTi) total scores?

Theoretical Framework

The adoption of a new idea is often a difficult process even when the new idea is advantageous to an individual or organization. A common problem among individuals and organizations is how to increase the rate of diffusion of an innovation. According to Rogers (1995),

> Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system. It is a special type of communication, in that the messages are concerned with new ideas. Communication is a process in which participants create and share information with one another in order to reach a mutual understanding (p. 5-6).

There are four main elements of the diffusion of innovations process: innovation, communication channels, time, and social system. The new idea in the message content is what gives diffusion its special character because some degree of uncertainty is involved in the diffusion (Rogers). A social change occurs through the act of diffusion due to the new ideas that are invented, diffused, and either adopted or rejected thus resulting in consequences. According to Rogers, diffusion includes either planned or spontaneous new ideas. The innovation-decision process is conceptualized by five main steps: (a) knowledge, (b) persuasion, (c) decision, (d) implementation, and (e) confirmation (Rogers).

According to Surry (1997), the diffusion theory is valuable to the field of instructional technology for three reasons. First, by better understanding the many factors that affect adoption of innovations, those individuals developing technology-professional development programs will be better able to explain, predict and account for the factors that facilitate or hinder the diffusion of a new idea. Second, individuals who understand the innovation process and theories of innovation diffusion will be more prepared to effectively work with potential adopters. Third, the study of diffusion theory could lead to the creation of an organized, prescriptive model of adoption and diffusion.

According to Anderson (1997), the Concerns Based Adoption Model (CBAM) is one of the strongest, empirically grounded theoretical models to result from educational change research of the 1970s and 1980s. Developed by Hall, Loucks, and colleagues at the University of Texas Research and Development Center for Teacher Education, the primary objective of the CBAM is to measure, describe and explain the process of change experienced by educators involved in implementing new curriculum materials and instructional practices. The CBAM further examines how that change process is influenced by interventions from individuals acting in change-facilitating roles (Hall & Loucks, 1978b).

The CBAM is grounded on several assumptions regarding classroom change in curriculum and instruction with regards to innovation adoption. According to Hall and Loucks (1978a), if an individual perceives an idea, practice, or object as new then it is an innovation. There are six assumptions associated with innovation adoption with regards to the CBAM. First, change is a process not an event. Change takes time and is only achieved in stages. Second, the individual must be the primary target of the interventions designed to facilitate change in the classroom. CBAM is based on the conviction that classroom and/or schools cannot change until the individuals/teachers within them change. How an individual perceives the change will affect the implementation process. Fourth, individuals experiencing change go through stages in the perceptions and feelings about the innovation as well as their skills in using the innovation. Fifth, professional development must address the needs of the trainees rather than those of the trainers. Change facilitators must identify the location of their teachers in the change process and direct their interventions toward resolution of those identified needs. Finally, the change facilitators must constantly assess the progress of the individuals within the change process and be able to adapt interventions to the latest identified needs (Hall & Loucks, 1978b).

The crucial assumption of CBAM theory is that change can be facilitated. Individuals such as principals, department heads, and curriculum/technology coordinators who work in change-facilitating roles are capable of evaluating educator concerns about a change, their levels of use, and their configurations of use. Based on this information, interventions may be planned and delivered to aid individuals or groups of educators in effectively implementing the change (Anderson, 1997; Hall & Loucks, 1978b). As with any groups, individuals with different concerns and skills will be present. Professional development must be individualized and personalized so that each teacher's concerns are addressed while also addressing professional development budgets and time constraints. The use of small homogeneous groups, designing options within the professional development sessions, and providing school-based training programs all assist in the resolution of this dilemma (Hall & Loucks). In addition, comparing teachers' concerns with demographic factors such as "age, sex, years of experience, and cycles of experience with the innovation…can lead to further explanations and interpretations of concerns data" (Hall, George, & Rutherford, 1986, p. 52).

Conceptual Framework

In 1995, Moersch created a conceptual framework that he referred to as the Level of Technology Implementation (LoTi) Framework. The creation of the LoTi Framework resulted from the need for a dependable set of measures that would accurately reflect an educator's increasing competency of teaching with technology (Moersch, 2001). Moersch incorporated the Concerns Based Adoption Model developed by Hall, Loucks, and colleagues with information from the Apple's Classrooms of Tomorrow research and hundreds of his own classroom observations to design a conceptual framework that focused more on instruction and assessment and less on how the technology accomplished isolated tasks (Moersch, 1995, 2001).

The framework focuses on technology as an interactive learning tool that has the greatest and longest lasting impact on classroom learning; yet, technology as an interactive learning tool is often the most difficult to implement and assess (Learning Quest, 2004b). Rather than evaluating how technology is used to accomplish isolated tasks such as typing a research paper or browsing the Internet, Moersch wanted to evaluate how technology was being integrated to support “purposeful problem-solving, performance-based assessment practices, and experiential learning, all characteristics of the ‘Target Technology’ level established by the CEO Forum on Education and Technology” (Learning Quest; Moersch, 2001).

The Levels of Technology Implementation Framework uses a scale that is broken into eight levels ranging from Nonuse to Refinement. As an educator progresses through the eight levels, the instructional focus progresses from a teacher-centered to a learner-centered orientation (Learning Quest, 2004a; Moersch, 1997). The use of technology also shows a progression from an emphasis on isolated uses such as drill and practice applications to “an expanded view of technology as a process, product, and tool to augment and enhance students’ critical thinking and help them find viable solutions to real world problems” (Learning Quest, 2003, p.3). According to Learning Quest (2004a), the framework for the LoTi is aligned with state and national frameworks such as the Texas STaR Chart, Florida STaR Chart, and ISTE’s NETS and TSSA. As of 2004, ten states and thousands of school systems worldwide have adopted the LoTi as their tool to evaluate their efforts toward improving instructional practices (Learning Quest, 2004a)

Significance of Study

Teacher education and professional development programs should be catered around standards for student learning and for excellence in teaching practice (Darling-Hammond, 1997; Hamsa, 1998; Wise, 1996). One strategy for creating a greater cohesiveness between theory and practice is the development of technological skills that support student and teacher learning in the information age (Darling-Hammond). Identification of predictors of educators’ level of technology implementation can benefit professional development leaders in addition to school and county administrators when designing technology-professional development programs that have the biggest impact on instruction.

Although the large public school system has typically used a train-the-trainers model of technology-professional development, the current Comprehensive Instructional Technology Plan (GCPS, 2006a) calls for the investigation into other methods of technology-professional development including the use of online tutorials and class technology training. By identifying common predictors of educators' level of technology implementation such as method of completing the technology requirement for recertification, certification field, grade level, age, and gender, technology-professional development leaders will possess information that could impact the type of delivery methods of technology-professional development in addition to organizational considerations such as methods of grouping participants.

Summary

School systems are investing significant money to increase the availability of computers and other forms of technology for student and teacher use (Zucker et al., 2000). Teachers must have the confidence to know when and how to use technology within instruction (Burke, 1998; Hardy, 1998; Office of Technology Assessment, 1995). Teacher education and professional development programs should be catered around standards for student learning and for excellence in teaching practice (Hamsa, 1998; Wise, 1996). One strategy for creating a greater cohesiveness between theory and practice is the development of technological skills that support student and teacher learning in the information age (Darling-Hammond, 1997).

Consideration should be made regarding factors such as method of completing a technology requirement (Criscione, 2005; Sheumaker et al., 2001), certification field (as identified in other literature as subject area) (Barron et al., 2003; Becker, 2001; Hanks, 2002), grade level (Barron et al.; Becker; Bebell et al., 2004; Hanks; McCannon & Crews, 2000), age (Baack & Brown, 1991; Czaja et al., 2006; DeOllos & Morris, 2003; Morris, 1989), and gender (Broos, 2005; Correll, 2001; Craig, 1999; Hargittai & Shafer, 2006; van et al., 2004).

New national reform movements and state-driven policies and standards have resulted in an increased demand for professional development at the local level specifically in technology use. States have assumed the leadership role establishing new academic standards, teacher certification requirements, technology standards for teachers and students, and technology standards for teacher preparation programs. States have also been the driving force behind the development of state technology plans, goals, and reform movements aimed at aligning the states with federal programs and objectives (Zucker et al., 2000).

Reacting to this need for increased technology standards for teachers, a large public school system in Georgia established three options for their educators to meet the technology requirement for recertification which included: a test-out portfolio, ITT, and AssessOnline (GCPS, 2001, 2006b). Building upon the Concerns Based Adoption Model and the Level of Technology Implementation Framework, the Level of Technology Implementation (LoTi) Questionnaire was created to assess classroom practices tied to higher order thinking skills (Moersch, 1997). The LoTi Questionnaire assists decision-makers in determining how school building level stakeholders (teachers, administrators, technology specialists) are either implementing or supporting the use of technology associated with influential teaching or learning opportunities (Learning Quest, 2003).

CHAPTER 2

REVIEW OF RELATED LITERATURE

Chapter two is a review of literature and related research dealing with past and present methods of professional development, including technology professional development; technology and education reform; technology in schools; and the LoTi Questionnaire. The major objectives of this review are to:

1. Describe historical perspective of professional development for in-service teachers.
2. Describe the professional development of in-service teachers.
3. Present professional development models.
4. Describe technology-professional development.
5. Identify technology and education reform movements in the United States.
6. Describe technology in Georgia Schools.
7. Present Diffusion of Innovations as a theoretical framework.
8. Present the Level of Technology Implementation conceptual framework.
9. Present the LoTi Questionnaire as a measurement tool including studies that have used the LoTi Questionnaire as a measurement tool.
10. Identify Factors Influencing the Use of Technology in Instruction.
11. Describe the Impact of Technology in Education.

Historical Perspective of Professional Development for In-service Teachers

The history of professional development can be traced back to public schools in colonial New England (Pushkin, 2001; Schiffer, 1980; Urban, 1990). In the late eighteenth century, the common school was established as a free school open to the public. The need for professional development training was recognized during this time due to the growing awareness of the difficulty of teaching, the uniformity of teacher pre-service preparation, and the desire to standardize schools (Gutek, 1983). While pre-service teachers attended institutes and normal schools established for elementary teachers, practicing teachers were encouraged and in some instances mandated to attend a teachers' institute (Edwards & Richey, 1963). Prior to 1865, the teachers' institute was the primary means of professional development with the ultimate responsibility of the teachers' institute being to improve practicing teachers' curriculum knowledge and stress the importance of self sacrifice and commitment to teaching (Schiffer; Urban). However, teachers received very little training in teaching specific courses (Pushkin).

By the 1850's, the purpose of training institutes and standards for effective professional training began to be changed by professional teachers. (Schiffer, 1980). Teachers began to consider themselves as professional individuals with technical and pedagogical training. During this time frame, county and state supervision of schools led to a greater conformity among members of the teaching profession. It also was during this time that the development of the graded school resulted in the increased need for teachers with specialization within specific curriculum areas (Edwards & Richey, 1963; Schiffer). Improving the education and status of teachers became a focus of the local, state, and national teacher organizations that developed during this time period such as the National Education Association (NEA) and the American Federation of Teachers (AFT). A great benefit of these teacher organizations was the publication of journals such as the *Illinois Common School Advocate*, the *Massachusetts Teacher*, and the *New York Teacher* that distributed information and promoted reforms (Schiffer).

After the Civil War, teacher education began to stress the development of individual teaching styles, pedagogical skills, and uniform standards for the measurement of effective teaching (Schiffer, 1980; Schwartz, 1996). A greater responsibility taken on by the institutes was the establishment of teaching standards. New professional development programs for in-service and pre-service teachers contributed to the immediate improvement of the quality of educators (Edwards & Richey, 1963). The period after the Civil War to the early 1930's was marked by an increased demand for skilled and cultured teachers (Schiffer). Although in 1910, institute attendance was mandatory in twenty-eight states, teachers and teacher educators attacked the teachers' institutes because of their inability to fulfill the needs of well-trained teachers. Reading circles that exposed teachers to exceptional books to upgrade teachers' academic and professional skills became the common means for professional development. The reading circles were developed on a statewide basis and controlled by state authorities. Summer schools, extension courses, after-hours classes, and correspondence studies also became means of educating practicing teachers. These methods of professional training allowed practicing teachers to expand their professional knowledge while working full-time jobs (Schiffer).

Beginning in the 1920's, the perceptions teachers had about their role in the educational system began to change (Schiffer, 1980). During this time, normal schools were authorized by legislation to offer four-year degree programs in education. These new degree programs resulted in the transformation of normal schools to be known as state teacher colleges (Pushkin, 2001; Schwartz, 1996; Urban, 1990). Teachers no longer thought of themselves as merely workers, but individuals who possessed thoughts regarding school policy. It was this shift in beliefs that led to new ideas regarding the purpose of professional development. Rather than focusing on upgrading the individual teacher's knowledge and skills, the focus became that of promoting professional growth for the school staff through a cooperative group effort. This shift from an individualistic to that of a group approach implied that changes in teacher performance should be tied to aspects of school renewal such as “improvements in curricula, programs, administrative procedures, and school-community relations” (Schiffer, p. 2).

Several trends in professional development were apparent during the 1920’s through the 1960’s. Stressed during this time period were: changes in school goals and methods; a supportive school climate (Pushkin, 2001) with good relationships between supervisor and teacher; cooperative efforts among the staff; identified individual and group needs; opportunities for working teachers based on those identified needs; and the use of research to identify and solve problems, needs, or concerns. Professional development took on the dual purpose of assisting members of the staff to become more competent in their professional roles as teachers and administrators and improving the quality of the school system’s educational program. Emphasized during this time frame was the need to establish an atmosphere of mutual respect, support, and creativeness (Hartford, 1964). Teachers began to take on an active role in the planning of professional development programs (Pushkin; Urban, 1990; Wood, 1994). No longer accepted was the opinion that administrators and supervisors were in a better position to identify needs of the teachers. A new emphasis was placed on self-evaluation (Schiffer, 1980). This self-evaluation by the teachers was supplemented with supervisor’s observations to help individual teachers identify their own professional development needs. During this time period, teachers wanted time during the day for professional development activities and also variety in the content. Teachers also desired the programs to be evaluated and then modified based on these evaluations. The active participation of the principal in all phases of the professional development program was also requested.

The Contemporary Era, beginning in the late 1950’s, produced a resounding thought among teacher organizations, such as the National Education Association (NEA) and the

American Federation of Teachers (AFT), that professional development should be governed by teachers and based upon needs identified by teachers (Dillon-Peterson, 1994; Schiffer, 1980). Professional development opportunities should be related to day-to-day job needs and be a part of teachers' job assignments. These organizations also believed that teachers should have the greatest voice in determining the content and delivery methods of professional development training programs that would be the most beneficial to the individual teachers for acquiring new skills and relevant knowledge. The workshop approach to providing professional development emerged as the cure-all for professional development education. Consisting of a number of teachers working with resource persons and a director, the workshop was designed to provide for individual growth in a group interaction setting. In this form of professional development, there was no preplanned schedule. Rather, teachers worked on problems of their choice under the direction of workshop members.

Teacher education programs during the 1960's and 1970's adopted a behaviorist curricula and training methods whereby actions of educators were shaped by another person. Debates regarding the professional benefits of teacher education programs occurred during the 1960's. These debates led to the development, in 1965, of the first center for research and development on teacher education at the University of Texas-Austin (Pushkin, 2001). The need for highly skilled teachers in specific subject matters intensified. The demand for teachers to possess at least a bachelor's degree from an accredited college or university increased. Teacher education programs were encouraged to provide more in-depth training in specific subject matter yet also continue to offer sufficient training over all aspects of education. The number of teachers holding degrees beyond a bachelor's level also began to increase. A seven step lesson plan derived by other educators from Madeline Hunter's teaching/supervision model was used extensively in teacher education courses. Teachers were instructed to follow the seven steps in each lesson regardless of subject or educational context (Pushkin).

The model of choice during the 1980's moved away from a one size fits all workshop approach of providing professional development and returned to an individualistic approach to learning (Schiffer, 1980). The NEA supported individualistic learning and encouraged teachers to follow their own interests and needs. On-going learning either by professional development or continued education was encouraged during this time period. Many states began to require teachers to hold a graduate degree. Accountability became critical for teacher education programs resulting in testing for teacher competence to become routine. The development of a nationally consistent teacher certification process also began (Pushkin, 2001; Urban, 1990).

According to Dillon-Peterson (1994), professional development in the 1990's included not only individualized but also group/organization learning activities such as school restructuring, team-teaching, and organization development. All of these group activities relied on the individual and the critical contributions he or she made in a group setting for the individual and group members to thrive. The debate regarding the level of education a teacher must possess continued through the 1990's. Many states began to require at least a master's degree for permanent certification to show an increased level of professionalism. Teacher education programs began to not only provide instruction on content but also increasing pedagogical knowledge within the masters programs.

According to Loucks-Horsley (1994), seven areas of professional development have shown significant advances throughout the later part of the twentieth-century. First was the recognition of the importance of professional development. No longer was professional development seen as an add-on or luxury. Rather, professional development was viewed as a necessity for reform on both a large and small scale. Second, professional development creators were gaining a growing knowledge about the adult learner and what helped adults change their understandings, beliefs, and behaviors. Third, professional developers were now viewing schools as communities of learners with both students and teachers participating in the learning process. Fourth, a strong research base was being developed for training models and strategies that would facilitate the learning process. Fifth, attention was being focused on the complexity of change. This increased focus on the change process led professional development creators to include organizational development with a focus on student development in the planning process. The sixth advancement in professional development was the creation of alternative models of professional growth. Action research, peer coaching, and professional networking were examples other than workshops of professional development activities. Finally, attention was focused on on-the-job training, also known as embedded learning experiences, as a form of professional development. This type of professional development was a creative solution for finding time for professional development activities.

During the 2000 presidential election campaign, Bush continually proclaimed that no child will be left behind (Pushkin, 2001). Rather than focusing on children or the curricula, reform movements focused topics such as alternative teacher certification programs and requiring master's degrees for teachers (Pushkin). The NCLB Act of 2001 was a dramatic federal education law that tied federal aid to compliance with requirements such as the placement of highly qualified teachers in every classroom (National Education Association, 2006). The NCLB Act was not new. Rather, it was an extension of many requirements initiated under the 1998 reauthorization of the Higher Education Act (HEA) and personified in the last forty years of federal involvement in school reform (Ramirez, 2004). School systems were investing significant money to increase the availability of computers and other forms of technology for student and teacher use. State and school leaders were concerned about the impact of this huge investment (Zucker et al., 2000). According to Burke (1998), research has found that a teacher's skill level incorporating technology into instruction was the primary factor in improving student learning with technology. Teachers must have the confidence to know when and how to use technology within instruction (Hardy, 1998; Office of Technology Assessment, 1995).

The Enhancing Education through Technology Act of 2001, Title II, Part D of NCLB, provided grants for states that meet specific requirements integrating technology into instruction (Barron et al., 2003). The NCLB Act strived to accomplish this goal by streamlining redundant technology programs into a performance-based technology grant program that sent more money to schools (National Education Association, 2006). By consolidating the technology grant programs and allocating E-rate funds by using a formula, schools no longer had to submit multiple grant applications for educational technology funding. According to NCLB, the single program method would facilitate comprehensive and integrated education technology strategies that met the specific, individual needs of schools. A key point in this streamlining was that education technology funds should be focused on proven means of enhancing education through advanced technology. Rather than focusing on hardware and programming, government officials and educators advocated the need for technological skills (Barron et al.). Performance goals developed by the individual states to measure how federal technology funds were positively impacting student achievement were encouraged (National Education Association).

Professional Development of In-Service Teachers

Professional development of teachers is often referred to as staff development. According to Gall and Vojtek (1994), staff development is defined as “any effort to improve teachers’ knowledge, skills, and attitudes so that they perform their roles more effectively” (p. 1). For professional development to critically impact education, increased attention must be given to its association to program adoption and implementation. According to Bishop (1976), there are three general objectives of professional development. First, there must be knowledge conveyed about the new idea or intended change that includes the rationale, concepts, objectives, and strategies involved. The conveyance of information can be achieved by video, learning modules, general meetings, publications, programmed instruction, or other communication processes (Nevills, 2003). The second objective of professional development is the development of competencies.

> For competency to exist there must be not only the opportunity to observe, to practice, to experiment, to prepare, to transact, and to evaluate, but also a situation to receive prompt feedback and reinforcement regarding style and effectiveness, followed by an opportunity to try again (Bishop, p. 15).

Finally, professional development must seek commitment from those involved in the learning process if knowledge is to be used correctly. Commitment and a positive attitude among participants can not be obtained by knowledge alone. Interaction, involvement, participation, identification, and support are also needed. Techniques such as discussion groups, laboratory experience, and a multi-sensory proprietorship become essential (Bishop; Brandt, 2003).

A number of critical assumptions can be made regarding professional development (Wetherill, Burton, Calhoun, & Thomas, 2001). These assumptions indicate that all involved in the professional development process should: (a) uphold high expectations for continuous professional development, (b) continuously evaluate one's professional competence, and (c) deliberate and collaborate with peers. The field of education requires that all participants become lifelong learners and engage in activities that promote professional growth. Schools must support lifelong learning experiences that meet individual as well as organizational needs. Self-evaluation of accomplishments is both informative and gratifying. By looking at past accomplishments, individuals can assess what they must do next to facilitate further growth. By answering questions such as: What do I need to do to become more effective in my work? What additional knowledge or skills would make me a more effective teacher? and What experiences will continue my effectiveness with my students and colleagues?, a clear path can be developed towards attaining the new goals identified. A critical part of this reflective practice is the development and redevelopment of a platform of beliefs about teaching. Educational organizations are personified as communities of learning. For this to be true, teachers need the opportunity to think about their teaching practice with their peers (Brandt, 2003; Nevills, 2003). Beliefs, experiences, questions, and insights should be discussed. Individual and group interaction should stimulate curriculum discussion. According to Wetherill et al., these assumptions become the foundation for the reexamination of current practices, the development of new ideas and concepts, and for realignment of roles and responsibilities of educators in organizations.

Throughout the late 1980's and early 1990's, many schools of education increasingly incorporated new knowledge regarding teaching and learning into their training programs for prospective teachers. More attention was being placed on learning and cognition in addition to a greater appreciation for content knowledge and constructivist teaching. These changes were an attempt to empower teachers to constantly increase and develop their knowledge about teaching as their job requires (Darling-Hammond, 1996).

According to Garmston (2002), effective group professional development programs are based on three premises. First, members must have the skills and knowledge to be active participants. By being active participants in a group setting, individual members are shaping their own personal decisions and behaviors along with achieving a collective goal. Second, effective groups use dialogue versus discussion (Hughes & Schultz, 1976; Loser, 2006). Dialogue opens the door to generate and organize data, develop plans, apply logic and reason, and reach decisions. A group would develop more strategies for incorporating the professional development topics than participants would individually. Also, participants who are weak in the particular training area can learn strategies voiced by the stronger participants. Decisions made without dialogue are most likely to fail. The third premise for an effective group is that those involved understand the decision making authority and what decision making process will be used. There is clarity and agreement on meeting roles and the members are responsive to interactions between the physical environment and group performance.

Group members who take ownership of their groups and understand that individually and jointly they affect the groups' workings are at the very heart of effective groups. According to Garmston (2002), individuals have four responsibilities as group members. The individual should understand his or her intentions and choose appropriate behavior. Clarity is the source of impulse control, patience, listening, and speaking. Secondly, individuals must put aside ineffective methods of listening, responding, and inquiring. Listen to what other group members say and respond productively (Conley, Fauske & Pounder, 2004). Third, individuals must know when and how to assert themselves. Individuals should speak up when groups stray off task or to support an idea. Energy of the individual must be aligned with the purpose of the meeting. Finally, every individual should know and support the group's purposes, topics, processes, and development. These four responsibilities of group members are the invisible skills that form the foundation for group effectiveness.

Professional Development Models

There are many models associated with professional development. In an article for the National Staff Development Council, Sparks and Loucks-Horsley (1989) described five models of professional development commonly used. Those models include: (a) individually guided professional development, (b) observation/assessment, (c) involvement in a development/improvement process, (d) training, and (e) inquiry. According to Sparks and Loucks-Horsley, these models are used by school systems to guide the design of their professional development program. Technology may or may not be included as a primary area of focus of these models.

The primary characteristic of the first model, individually guided professional development, is that the learning is designed by the participating teacher (Sparks & Loucks-Horsley, 1989). Each teacher chooses goals to be achieved and activities that will result in attainment of those goals. Theory supporting the individually guided professional development model comes from a number of individuals. Adult learning theorists such as Kidd and Knowles believe that adults are self-directed in their learning and that their readiness to learn is stimulated by real life tasks and problems (Knowles, Holton III, & Swanson, 1998). Learning styles researchers such as Dunn (1990) state that individuals are different in the ways they view and process information and in the way they most effectively learn.

Assumptions of the individually guided professional development model include: individuals can best determine their own learning needs and are capable of self-directed and self-initiated learning, adults learn most efficiently when they plan their own learning activities, and individuals will be most motivated when they choose their own learning goals based on their personal evaluation of their needs. Participants of individually guided professional development pass through four phases. First, they must identify a need or area of interest. Second, a plan must be developed to meet the need or area of interest. Third, the participants must participate in the learning activities. Finally, the learning must be assessed to determine if it meets the identified need or area of interest. Examples of individually guided professional development activities range from a teacher reading a professional journal article to a teacher designing and carrying out professional projects (Sparks & Loucks-Horsley, 1989).

According to Worth (2001), individualized professional development programs that cater to a teacher's specific training needs often produce positive and longer-lasting results compared to group professional development programs that use similar activities for all participants. A professional development strategy that may be used to support a more individualized learning opportunity is the idea of offering a number of professional development opportunities (Worth). Teachers may then choose the option(s) and that best meets their needs. Plans are then developed and formalized through a contract between the participant and his/her supervising administrator. This contract model of professional development allows educators to individually assist in the planning and managing of their professional development.

The second model of professional development addressed by Sparks and Loucks-Horsley (1989), observation/assessment, is often associated by teachers with assessment. However, this model takes on many forms such as peer coaching and teacher evaluation that are familiar and widely used by teachers. Theory and research for the observation/assessment model may be found in the literature on teacher evaluation, clinical supervision, and peer coaching (McGreal, 1982; Showers & Joyce, 1996).

Four assumptions are associated with this model. The first assumption is that reflection and analysis are essential keys to professional growth. Self-reflection is enhanced by another's observation is the second assumption. The third assumption is that both the teacher being observed and the observer can benefit from the observation. Finally, when teachers see the positive impact of their change efforts, they will become more willing to continue the change process. The observation/assessment model usually consists of a pre-observation meeting, observation, analysis of information, and then a post-observation meeting. Important improvements have been made to student achievement when the guidance of teachers in effective instructional practices is followed by observations and coaching in the classroom (Sparks & Loucks-Horsley, 1989).

The third model, involvement in a development/improvement process, focuses on the combination of knowledge that results from the involvement of teachers in the development/improvement process (Sparks & Loucks-Horsley, 1989). Theoretical sources associated with the involvement in a development/improvement process model include Glickman and Glatthorn (Sparks & Loucks-Horsley). Glickman (1986) feels that the goal of any staff development should be to develop teachers' abilities to think and that curriculum development is the solution to this process. Glatthorn (1993) has identified three ways that teachers can change a district's curriculum guide. First, teachers may take a district's curriculum guide detailing the objectives and recommended teaching methods and develop usable instructional guides. Second, teachers may adapt the instructional guides to meet the individual needs of the students. Finally, teachers may enhance the curriculum guides by developing enrichment units (Glatthorn).

One assumption of this model is that adults learn best when they have a need to know. Another assumption is that those who work closest to the job best understand the performance that is required. A final assumption is that teachers gain vital knowledge through their involvement in school improvement or curriculum development. The first phase of this model begins with the identification of a problem or need. This problem or need could be associated with the individual, a group of teachers, school, or district. A response must then be formulated. Specific knowledge or skills are then identified to effectively implement the plan. Finally, after the plan is implemented or the product developed, the program success is evaluated. When teachers have the tools needed to effectively complete the process, this model supports the achievement of the desired outcomes (Sparks & Loucks-Horsley, 1989).

Training, which is synonymous with professional development, is the fourth model (Sparks & Loucks-Horsley, 1989). Activities such as lecture, demonstration, role-playing, and simulation may be used by the trainer. Theories associated with the training model of professional development include constructivism and behaviorism (Kramlinger & Huberty, 1990; Rizza, 2000).

The training model of professional development assumes that there are behaviors and techniques worthy to be replicated in the classroom. Another assumption is that behaviors of teachers can be changed and new behaviors added to their classroom instructional practice. The final assumption and major advantage of the training model is the high participant-to-trainer ratio resulting in extreme cost effectiveness. Although the training material; who will provide the training; and when, where, and for how long the training will take place is typically decided by an administrator or the trainer, participants should also be involved in the planning process. For the more complex teaching skills, peer observation and coaching are necessary for effective transfer (Sparks & Loucks-Horsley, 1989).

The fifth model of professional development is inquiry. Inquiry can take place on an individual basis or in groups, formally or informally, in the classroom or at a remote location. Inquiry focuses on teachers having the ability to formulate valid questions about their own instructional practice and pursue answers to those questions (Sparks & Loucks-Horsley, 1989). A number of theorists and researchers have advocated for various forms of inquiry. Tikunoff and Ward's (1983) model of interactive research and development along with Lieberman and Watts all state that inquiry is promoted through the use of questions and by working on collaborative teams (Lieberman, 1986).

There are three assumptions associated with the inquiry approach to professional development. First, teachers are intelligent, questioning individuals with legitimate expertise and important experience. Second, teachers are prompted to search for data to answer important questions and reflect on that data to develop solutions. Third, teachers will develop new understandings as they progress through the questions and answers. The common form of the inquiry model has teachers first identifying a problem. Next, they explore ways of collecting data and then analyzing that data. Finally, changes are instituted and new data is gathered to assess the effects of the change. The impact of these various models depends not only on their individual or combined use, but also the attributes of the organization in which they are used (Sparks & Loucks-Horsley, 1989).

Another model of professional development is Cognitive Apprenticeship. According to Browne and Ritchie (1991), one-shot or short-term training sessions with little or no follow-up are not effective. Programs that include support as well as instruction are more effective to participants. The Cognitive Apprenticeship model is an example of this type of training. The framework for developing technology-professional development programs based on cognitive apprenticeship consists for four key components: (a) instruction, (b) modeling, (c) coaching, and (d) empowerment. By using authentic activities in the technology-professional development program, the transfer of skills from training to the classroom is improved. During the training program, trainers should model the skills being taught and discuss the positives as-well-as possible obstacles the teachers may encounter. This modeling and discussion provides teachers support and feedback by developing fluency in the participant's knowledge acquisition, retention, and usage (Beavers, 2001; Hockly, 2000). To encourage classroom application of new technology skills, teachers need to develop and sense of autonomy and confidence with using the new technology in skills in the classroom with students. Autonomy and confidence is developed through fading, articulation, reflection, and exploration.

During the fading process, there is a gradual removal of support, including the withdrawal of modeling and coaching, with the goal of teachers completing tasks on their own. During the articulation, teachers are encouraged to talk about their knowledge, reasoning, or problem-solving skills. This discussion is encouraged by teachers being questioned by coaches about their skills and encouraged to think aloud during the problem-solving process. During reflection, the performance of the learners is compared to that of an expert. This comparison results in the creating of self-monitoring and diagnosis skills. Teachers are encouraged during exploration to try new tasks. As skills levels increase, the use of modeling and coaching will decrease and exploration into new tasks will increase (Browne & Ritchie, 1991).

Effective integration of technology into the curriculum can be assisted by the use of three professional development models: (a) peer coaching (Bybee & Loucks-Horsley, 2000), (b) study groups, and (c) thematic curriculum (Beavers, 2001). Rather than focusing on rote memorization and the development of isolated skills, these models support learning and stress the ability to access, interpret, and synthesize information.

Another professional development model used by the Tremont, Illinois Community Unit District is the creation of professional growth plans. The Tremont model is based on concept of self-directed learning (Peine, 2003). This model assumes that (a) learners are accountable for their learning; (b) needs of the learners are being met; (c) current ability levels of all learners are identified and each learner is encouraged to develop to his or her potential; (d) learners monitor growth through the collection of artifacts; (e) all learning styles are accommodated; and (f) learning occurs in an environment that promotes learning yet also encourages risk taking (Peine).

The professional growth plan process evolves through four phases. First, there is an identification of need. Teachers complete a self-assessment based on previously established performance standards. The results of the self-assessment are then discussed with a school leader and goals are established for professional growth. Second, a topic for learning is established. How growth in that topic area will impact student learning is identified, a time-line is established for completing the professional growth plan, types of evidence needed to document learning are identified along with how the growth plan will be evaluated. Third, the professional growth plan is put into place. Finally, the plan is evaluated. Throughout the growth plan, the school leader and teacher are using formative evaluation methods to ensure success. For professional growth to be achieved, new knowledge and skills must be acquired and applied to instructional methods in a manner that contributes to the learning community (Peine, 2003).

Westfield Washington Schools in Westfield, Indiana has had much success with a Teachers-as-Trainers model of technology-professional development (Cooley, 2001). The Teachers as Trainers model consists of four phases: (a) developing a needs assessment, (b) core team selection and planning, (c) delivery of training, and (d) personnel and program evaluation. These four phases attempt to move beyond traditional professional development programs by addressing conditions that impact the delivery of successful training such as: creating a common vision, faculty and staff empowerment, cooperative planning, continuous support, shared responsibility, and employee recognition (Meltzer & Sherman, 1997). Developers of the Teachers as Trainers model feel that these conditions form the building blocks that have become the base for effective professional development and organizational change (Cooley).

Another model of technology-professional development is Training-On-Demand used in Ralls, Texas. This model of technology-professional development uses a three component approach: whole-group instruction, written procedures, and one-on-one or small group sessions (Boyd, 1997). Whole-group instruction has been modified in the Training-on-Demand approach so that its use is limited to providing overview information about technology and its uses. Vision-building and encouragement of participants does occur during whole-group time; however, detailed how-to instruction does not. During this time, technology is tied to classroom practice in a generalized way. Topics discussed during whole-group instruction include: what is a network, internet resources, and data collection and analysis using technology. The second component of Training-On-Demand is written procedures. Instructions for step-by-step use of various types of technology are given to the entire learning group. Group members are encouraged to keep a notebook of these instructional handouts. The third component is one-on-one or small-group sessions. The technology trainer meets individually with the participants for intensive, individualized training sessions that complement the instructional handout previously received. Topics discussed during these training sessions include: E-mail, electronic grade books, creating student presentation, and how to use other electronic components such as an LCD projector. For this model to be successful, a full-time technology trainer must be employed and clearly defined technology goals identified (Boyd).

There are many models of professional development. However, to measure the effectiveness of the different types of programs there must be some measure of evaluation. The primary purpose of evaluating professional development programs should be to guide decision making about the future of the program (Loucks-Horsley et al., 1987). Legitimate outcomes of professional development programs range from student, teacher, or organizational outcomes to changes in attitudes, beliefs, skills, and behaviors. Evaluation questions should specifically address the interests of the audience(s) and the resources available. Data collection and measurement strategies will vary depending on the results desired. Changes in participants are the most direct and immediate outcomes and also the easiest to document, measure, and relate to professional development program activities. Pre/post tests, self-assessment checklists, interviews, and surveys are methods used to document and measure changes in participants' attitudes (Elsbree & Howe, 1977; Grace, 2001). Professional development programs, at times, strive to make a difference in the organization by abandoning old practices and adopting new techniques. Although changes in organizational climate are often difficult to assess through a quantitative approach, qualitative strategies such as observations, surveys, and interviews provide useful feedback.

Technology-Professional Development

The goal of any professional development course is to inform and change educators' practices as a result of the new information. Getting teachers to see the importance of the program is especially critical for technology-professional development programs to be effective. According to Bailey and Lumley (1994), technology-professional development is defined as

> the integration of the emerging technologies into education by using a planned, ongoing, and comprehensive approach involving leaders (both administrators and teachers) who facilitate other stakeholders that are actively engaged in acquiring, upgrading, or abandoning knowledge, attitudes, and skills related to technology-based learning environment (p. 11).

The principle guiding any quality technology-professional development program is that the curriculum drives the use of technology and not the other way around (Meltzer & Sherman, 1997). Empowered teachers will develop ways to include technology into their ongoing instruction rather than view it as an unconnected activity (Bybee & Loucks-Horsley, 2000; Mouza, 2002). Compared to general professional development courses in areas such as classroom management, discipline, or methods to improve reading scores which are specifically targeted to classroom practice, technology-professional development is often a two-step process. Not only must teachers learn the specific technology being using but they must also understand how to effectively incorporate that technology into their curriculum (Brand, 1997; Bybee & Loucks-Horsley).

The goal of technology-professional development is to help educators at all technology skill levels experience incorporating technology as a dynamic part of their curriculum. The design of the technology-professional development program is critical to meeting this goal.

There are keys to successful design and development of effective technology-professional development programs. First, there must be sufficient time allocated for training (Bailey & Pownell, 1998; Brand, 1997; Meltzer & Sherman, 1997). Training should be provided outside of the normal school day responsibilities to allow teachers the opportunity to concentrate on training objectives. Second, when designing technology-professional development programs, individual differences must be addressed and individual strengths supplemented. To address specific needs and concerns, technology-professional development participants should be involved in the planning process (Council of Chief State School Officers, 1991; Meltzer & Sherman; Saylor & Kehrhahn, 2003). Third, there should also be flexibility of professional development opportunities (Hardy, 1998). Opportunities for face-to-face instruction and/or on-line instruction should be available to meet all learning style needs.

In addition to the keys to successful design, there should also be the establishment of organizational structures that allow for a shared vision of technology in the schools and also a long-range technology plan. Other steps schools should take to ensure successful technology-professional development opportunities are to provide participants access to the same technology in the training program that they will have in their classrooms, designing programs that allow for practice of new skills and feedback, structuring for follow-up support after the completion of the technology-professional development program (Brand, 1997; Fullan, 1991; Miller, 1998), considering incentives such as cash bonuses to reward mastery of the technology skills (Bradshaw, 1997; Brandt, 2003), and letting teachers have access to school equipment at home or during the summer to play and fine-tune new technology skills (Brand; Council of Chief State School Officers, 1991; Hardy, 1998).

For successful implementation of technology, school administrators are a major support network for teachers (Dawson & Rakes, 2003; Hardy, 1998). According to Meltzer and Sherman (1997), the school principal is responsible for leading the implementation of technology in four ways: obtaining resources, buffering implementation from outside interference, encouraging teachers, and adapting current policies to meet new demands. To increase the probability of successful implementation, sufficient resource supplies of hardware and software must be available (Meltzer & Sherman). Also, adequate time and training must be available for skill building to increase the probability of successful implementation (Bailey & Lumley, 1994; Bailey & Pownell, 1998; Brand, 1997; Zucker et al., 2000). Principals must run interference for teachers while they learn, experiment, and implement. Teachers should not feel as though they are eluding their duties while they are developing technology skills. Teachers must also be assured that technology will remain a part of the school's education program and not a passing trend. Teachers should be encouraged by their principal to learn unique applications that fit their specific curricula. A one-size-fits-all model often reduces teachers' appeal and decreases exploration and adaptation (Hardy; Saylor & Kehrhahn, 2003). Finally, school principals should become leaders in the articulation of the new learning environment by becoming technologically literate. Principals who can associate with technological changes will have a greater respect and understanding of the tasks needed to become a competent technology user.

Research has shown that the best way for teachers to learn technology is through peer mentoring (Anderson, 2000; Brandt, 2003). Excellent technology-using teachers tend to work in environments of community support. Teachers who learn new skills through technology-professional development courses, university, or community classes should be encouraged to share the new knowledge with coworkers. School systems can support further training and skill development by encouraging and financially supporting teachers to attend related conferences at the school's expense. Teachers who are making positive strides in their technology use could receive additional access to hardware and software. Also, teachers could be given the opportunity to earn extra computers for their classrooms. Finally, schools might consider developing computer purchase assistance programs and summer and weekend loan programs to allow teachers increased access to technology away from school (Brand, 1997; Zucker et al., 2000).

For the implementation of technology-professional development programs to be effective, both the technical and human needs of the participants must be addressed. Participants in the professional development should be given the opportunity to participate in the planning process. Those participants should also be provided time and resources to develop their technical skills. Clear expectations should be outlined for participants and flexible scheduling and delivery options should be available. Finally, a sound evaluation process must be in place. Throughout all of these conditions, teachers' physiological needs must be accounted for within the program (Bailey & Pownell, 1998; Brand, 1997; Brandt, 2003).

Technology and Education Reform in the United States

A teachers' use of technology is a growing concern from local, state, and national leaders. This concern has led to technology training reforms for educators to improve technology competencies. In Georgia, The A Plus Education Reform Act of 2000, House Bill 1187, requires all Georgia public school educators, regardless of certification field demonstrate proficiency on a computer skills competency test or complete a training or course equivalent approved by the PSC for recertification (Georgia Legislature, 2000). All certified educators in

Georgia must complete the technology competency by July1, 2006 for recertification (PSC, 2006).

Other states have taken steps to address technology skills through a variety of reform movements. In Kentucky, pre-service and in-service teachers are expected to understand how to effectively use technology to support instruction. In addition to understanding how to use technology in the classroom, educators must also know how to retrieve and work with data, engage in professional growth, communicate effectively not only with fellow educators but also with parents and the community, and conduct research. Local school districts are responsible for assessing the skills of in-service teachers. Pre-service teachers are evaluated during their internship (Burke, 2000; Kentucky Department of Education, 2006).

Technology standards have been established in Texas for all new teachers regardless of certification field. The State Board for Educator Certification based these standards on the Texas Essential Knowledge and Skills for all students. This is an attempt to link public education with teacher preparation and accountability. Ultimately, these technology standards will be included in the new Examinations for Certification of Educators in Texas (Burke, 2000; Texas Education Agency, 2004).

Beginning in 2003, the State Board of Education in Virginia began to require all teachers to demonstrate technology proficiencies for license renewal. To meet this goal, approved teacher preparation programs were required to implement the new guidelines for students entering their programs by fall 2000. Local school districts were required to establish technology plans that incorporated state technology standards so that all educators would meet the standards by the 2002-2003 school year (Burke, 2000; Virginia Department of Education, 2006).

As of July 2000, South Carolina educators were required to demonstrate technology proficiencies for each five-year certification renewal. District plans for meeting this requirement were approved by the South Carolina Department of Education prior to distribution of technology funds. Educators needing to complete additional coursework were given the opportunity to substitute a technology-based course for a course in their content field (Burke, 2000; South Carolina Department of Education, 2006).

Technology in Georgia Schools

The A Plus Education Reform Act of 2000, House Bill 1187, was signed into law by Governor Roy Barnes in 2000 (Georgia Legislature, 2000). One requirement of Georgia's A Plus Education Reform Act of 2000, HB1187, was that all certified personnel must meet a special technology requirement. According to the PSC (2006), the governing body administering this requirement, all certificated personnel must complete this technology requirement by July 1, 2006. Certified personnel could meet this requirement by completing one of four options: a) National Board Certification or possessing a lifetime certificate, b) the InTech Professional Development course, c) a PSC approved course offered by a RESA, college or university, or other agency, or d) a PSC approved course included in an undergraduate or graduate school program or study (GCPS, 2006b).

If an educator in the large public school system in Georgia has not met this requirement through National Board or lifetime certification, completion of InTech, or completing a PSC approved college course or education program, he/she has three options to choose from at the local public school system level (GCPS, 2001). The first option is to complete a test out. This option requires the educator to sign a letter confirming his/her technology knowledge and skills and then independently completing an electronic portfolio meeting specified criteria. In addition, the educator would be evaluated by his/her local school evaluating supervisor regarding on-the-job technology integration performance (GCPS).

By choosing the test-out portfolio, each individual signs a contract with the Division of Information Management stating that he/she can complete all of the requirements of the ITT course within a specified timeframe chosen by the Division of Information Management. However, the individual will not receive assistance from the 50 hour technology professional development course the ITT participants receive or the assistance of other individuals to complete the portfolio. Each participant choosing the test-out portfolio method must also be observed by his/her evaluating administrator teaching one technology based lesson in a classroom setting using the Technology Integration On-the-Job Assessment Instrument (see Appendix A). The observation form may have no more than five items checked out of sixteen in the Does Not Meet Standards column. The observation form is signed by the evaluator along with the participant and turned in with the completed portfolio to the Division of Information Management. Completion of a portfolio that contains all components and artifacts and a successful observation results in completion of the test-out portfolio (GCPS, 2006b; G. Smith, personal communication, July 17, 2002).

The second option is to complete a 50-hour training course, Instructional Technology for Teachers (ITT), offered through the major public school system in Georgia's Information Management Division. Course participants would complete an electronic portfolio in addition to receiving an on-the-job technology integration performance evaluation by his or her local school evaluating supervisor. The course is offered at different school locations throughout the county and delivered by technology instructors previously approved by the state (GCPS, 2001).

Instructional Technology for Teachers (ITT) is a technology-professional development program designed to assist teachers, over a 50-hour instructional period, to learn how to not only improve their incorporation of technology into instruction but also increase their own level of personal technology competence (GCPS, 2006b; Sheumaker et al., 2001). ITT courses are offered at the elementary, middle, and high school levels at various times and locations throughout the district as a convenience to staff members. Any county employee needing to meet the technology requirement for certification or recertification may participate in the ITT program at no cost; however, the employee must enroll in a course offered for the grade level (elementary, middle, or high school) the individual teaches (G. Smith, personal communication, July 17, 2002).

During the technology-professional development course, each ITT participant creates a web-based or PowerPoint portfolio that is broken into seven components. Artifacts verifying the participant's ability to use various software application programs are included within each component. The seven components include: (a) Desktop Publishing for Instruction, (b) Research and Media for Instruction, (c) Communication for Instruction, (d) Presentation for Instruction, (e) Spreadsheets and Databases for Instruction, (f) Web Pages for Instruction, and (g) Assessment (GCPS, 2001; G. Smith, personal communication, July 17, 2002).

The first component, Desktop Publishing for Instruction must contain two artifacts demonstrating the participant's ability to use either Microsoft Word or Microsoft Publisher to enhance instruction. Example of artifacts include: brochures, flyers, and student writing projects (GCPS, 2001; G. Smith, personal communication, July 17, 2002). The second component is Research and Media for Instruction. This component must also contain two artifacts demonstrating the participant's mastery of objectives such as using Boolean search techniques to obtain results from online media resources or creating a research project for students around the use of the Internet (GCPS; G. Smith, personal communication). The third component, Communication for Instruction, contains at least two examples of the participant's mastery of using E-mail to document parent or student communication or E-mail based projects used by students (GCPS; G. Smith, personal communication). The fourth component, Presentation for Instruction, requires each participant to create a presentation using Microsoft PowerPoint for instruction. The presentation must contain at least five slides, text, graphics, and sound or animation (GCPS; G. Smith, personal communication). The fifth component, Spreadsheets & Databases for Instruction, requires two artifacts that demonstrate mastery. Examples of mastery include: use of an electronic gradebook, spreadsheet use in a lesson, or data tables or graphs of longitudinal data of student achievement (GCPS; G. Smith, personal communication). The sixth component of ITT is Web Pages for Instruction. The participant is required to create two web pages. Those web pages may be a teacher-created instructional web page, homework helper webpage, instructional web page related to teaching assignment, or a student-created web page as part of a class project (GCPS; G. Smith, personal communication). The final component of ITT is Assessment. The participant must provide two artifacts demonstrating mastery of assessment. Those artifacts may include: one item entered into the county sponsored Test Item Bank, a test created using the county sponsored Test Item Bank, a rubric for scoring a technology-based lesson, or a checklist to track student achievement of technology competencies (GCPS; G. Smith, personal communication). Reflective paragraphs must also be included with each artifact detailing why the artifact was chosen to be included in the portfolio and the instructional value of the artifact. The portfolio must be organized so that each of the components is easily accessible from one main index page (GCPS; G. Smith, personal communication).

Participants must also create three technology based lesson plans. The primary focus of these lesson plans is that they are centered on the use of technology. The lesson plans must detail the type of technology used including the software title and any additional hardware needed such as an LCD projector or digital camera. In addition to the requirements of non-technology based lesson plans such as a summary of lesson and steps to complete the lesson, the technology-based lesson plans must detail the technology competencies achieved by the students and/or teacher after the completion of the lesson. (GCPS, 2001; G. Smith, personal communication, July 17, 2002).

The final requirement for the completion of Instruction Technology for Teachers is that each participant must be observed by his/her evaluating administrator teaching one technology based lesson in a classroom setting using the Technology Integration On-the-Job Assessment Instrument (Appendix A). The observation form may have no more than five items checked out of sixteen in the Does Not Meet Standards column. The observation form is signed by the evaluator along with the participant and given to the ITT instructor at the end of the 50 hour technology training program. Completion of a portfolio that contains all components and artifacts, verification of 50 hours of attendance, and a successful observation results in completion of the program (GCPS, 2006b; G. Smith, personal communication, July 17, 2002).

The final option is the completion of the Georgia AssessOnline test that may be accessed at http://wwwgapsc.riverdeep.net. This is a proctored test that employees of this major school system in Georgia may signup for free of charge. After completing the online test, participants will receive a copy of their test score (GCPS, 2006b). To assist educators in making the decision of which program to choose, a website was created at http://www.gwinett.k12.ga.us/gtat/ providing an overview and general information on the test-out and training course options, forms necessary for either the test-out or course option, and a sample portfolio. A list of training sites and AssessOnline test dates are distributed through E-Mail to all county employees detailing training sites including dates and times (GCPS, 2001).

The AssessOnline test is another method of completing the technology requirement for recertification (PSC, 2007). A proctor, the LSTC at each school, administers the assessment and signs a form stating that the participant did not receive assistance during the test from other individuals or from written materials. The test usually lasts between 30 and 45 minutes and includes topics such as: Windows Operating Systems, Word Processing, Spreadsheets, Databases, Internet Navigation, and Presentation Methods. After the online test is completed, a score report is printed with the minimum overall score needed to pass being 175. According the PSC, individuals may take the test as many times as they need to pass.

Diffusion of Innovations

The adoption of a new idea is often a difficult process even when the new idea is advantageous to an individual or organization. A common problem among individuals and organizations is how to increase the rate of diffusion of an innovation. According to Rogers (1995),

> Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system. It is a special type of communication, in that the messages are concerned with new ideas. Communication is a process in which participants create and share information with one another in order to reach a mutual understanding (p. 5-6).

The new idea in the message content is what gives diffusion its special character because some degree of uncertainty is involved in the diffusion (Rogers). A social change occurs through the act of diffusion due to the new ideas that are invented, diffused, and either adopted or rejected thus resulting in consequences. According to Rogers, diffusion includes either planned or spontaneous new ideas.

There are four main elements of the diffusion of innovations process: innovation, communication channels, time, and the social system. The first element, innovation, "is an idea, practice, or object that is perceived as being new by an individual or other unit of adoption" (Rogers, 1995, p. 11). If the ideas seems new to the individual, it is an innovation regardless of when the idea was first used or discovered. Newness of an innovation may be expressed in terms of knowledge, persuasion, or a decision to adopt.

Five characteristics of innovations help to explain their different rates of adoption. Relative advantage is the first characteristic on innovations. This is the degree to which an innovation is perceived as being better than previous ideas. The greater the perceived advantage of an innovation by the individual results in a faster rate of adoption. The second characteristic of an innovation is compatibility. Compatibility is the degree a new innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters. New ideas that are perceived as being compatible with existing beliefs or previous experiences will experience a faster rate of adoption. The third characteristic of an innovation is the degree an innovation is perceived as difficult to understand and use. The easier an innovation is to understand and use results in a faster rate of adoption. The fourth characteristic of an innovation is triability. This is the degree an innovation may be experimented with on a limited basis. Triable innovations represent less uncertainty to the individuals considering it for adoption. The final characteristic of innovations is observability. Observability is the degree the results of an innovation are visible to others. The easier it is for individuals to see the results of an innovation, the faster they are to adopt it (Rogers, 1995).

The second element in the diffusion of innovations process is communication channels. Diffusion is a type of communication where the message content being exchanged is concerned with a new idea. This process involves an innovation, an individual that has knowledge of the innovation, another individual that does not yet have experience with the innovation, and a communication channel between the two units. Diffusion research suggests that most individuals depend upon a subjective evaluation of a new idea that is conveyed to them from other individuals like themselves who have previously adopted the innovation. The dependence on peer experiences suggests that diffusion is a social process (Rogers, 1995).

The third element in the diffusion of innovations process is time. According to Rogers (1995), the inclusion of time in diffusion research is one of its strengths. The time dimension is represented in diffusion in (a) the innovation-decision process when an individual moves from first knowledge of an innovation through its adoption or rejection, (b) the earliness or lateness an innovation is adopted relative to other members of a system, (c) an innovation's rate of adoption measure by the number of members in a system who have adopted the innovation in a give time period.

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

The innovation-decision process is conceptualized by five main steps: (a) knowledge, (b) persuasion, (c) decision, (d) implementation, and (e) confirmation (Rogers).

The fourth element in the diffusion of innovations process is a social system. According to Rogers (1995), a social system is "a set of interrelated units that are engaged in joint problem-solving to accomplish a common goal" (p. 23). The social structure of a system can facilitate or hinder the diffusion of innovations in a system. Innovations can be adopted or rejected (a) by an individual member of a system or (b) by the entire social system either as a mutual agreement or by an authority decision.

According to Surry (1997), the diffusion theory is valuable to the field of instructional technology for three reasons. First, by better understanding the many factors that affect adoption of innovations, those individuals developing technology-professional development programs will be better able to explain, predict, and account for the factors that facilitate or hinder the diffusion of a new idea. Second, individuals who understand the innovation process and theories of innovation diffusion will be more prepared to effectively work with potential adopters. Third, the study of diffusion theory could lead to the creation of an organized, prescriptive model of adoption and diffusion.

Concerns Based Adoption Model

According to Anderson (1997), the Concerns Based Adoption Model (CBAM) is one of the strongest, empirically grounded theoretical models to result from educational change research of the 1970's and 1980's. Developed by Hall, Loucks, and colleagues at the University of Texas Research and Development Center for Teacher Education, the primary objective of the CBAM is to measure, describe, and explain the process of change experienced by educators involved in implementing new curriculum materials and instructional practices. The CBAM further examines how that change process is influenced by interventions from individuals acting in change-facilitating roles (Anderson; Bailey & Palsha, 1992; Hall & Loucks, 1978b).

After extensive experiences with innovations in educational settings, the CBAM was developed (Hall & Loucks, 1978b). The CBAM is grounded on several assumptions regarding classroom change in curriculum and instruction with regards to innovation adoption. According to Hall and Loucks (1978a), if an individual perceives an idea, practice, or object as new then it is an innovation. There are six assumptions associated with innovation adoption with regards to the CBAM. First, change is a process not an event. Change takes time and is only achieved in stages. Second, the individual must be the primary target of the interventions designed to facilitate change in the classroom. CBAM is based on the conviction that classroom and/or schools cannot change until the individuals/teachers within them change. Third, change is a highly personal experience. Fourth, individuals experiencing change go through stages in the perceptions and feelings about the innovation as well as their skills in using the innovation. Fifth, professional development must address the needs of the trainees rather than those of the trainers. Change facilitators must identify the location of their teachers in the change process and direct their interventions toward resolution of those identified needs. Finally, the change facilitators must constantly assess the progress of the individuals within the change process and be able to adapt interventions to the latest identified needs (Anderson, 1997; Hall & Loucks, 1978b; McCarthy, 1982).

The crucial assumption of CBAM theory is that change can be facilitated. Individuals such as principals, department heads, and curriculum/technology coordinators who work in change-facilitating roles are capable of evaluating educator concerns about a change, their levels of use, and their configurations of use (Bailey & Palsha, 1992). Based on this information, interventions may be planned and delivered to aid individuals or groups of educators with effectively implementing the change.

The Concerns Based Adoption Model is comprised of three diagnostic tools for identifying and measuring change in individuals: Stages of Concern, Levels of Use, and Innovation Configurations (Anderson, 1997; Hall & Loucks, 1978b). Motivations and feelings an educator may have about change within the curriculum or any other instructional practice at various implementation points is measured through the Stages of Concern framework. Rather than focusing on teacher attitudes about a change as the Stages of Concern does, the Levels of Use framework focuses on behavior patterns of educators as they go through the implementation process. Because educators rarely use the same methods to implement a new innovation, Innovation Configuration (IC) Component checklists are used to describe variations of the innovation in practice by the different educators. An IC symbolizes the pattern of practices across all innovation components that describe the implementation by the individual educator. The same innovation implemented by different educators will result in different configurations of use resulting in other versions of the innovation in practice. An IC Checklist may also identify some components as vital to implementation of the innovation (Anderson; Hall & Loucks).

Level of Technology Implementation Framework

In 1995, Moersch developed the Levels of Technology Implementation (LoTi) framework in an effort to accurately measure authentic classroom technology use. The framework focuses on technology as an interactive learning tool that has the greatest and longest lasting impact on classroom learning yet is often the most difficult to implement and assess (Learning Quest, 2004b). Rather than evaluating how technology is used to accomplish isolated tasks, Moersch wanted to evaluate how technology was being integrated to support “purposeful problem-solving, performance-based assessment practices, and experiential learning-all characteristics of the ‘Target Technology’ level established by the CEO Forum on Education and Technology” (Learning Quest; Moersch, 2001).

The Levels of Technology Implementation Framework uses a scale that is broken into eight levels ranging from Nonuse to Refinement. The definition of each level is explained in Appendix B. As an educator progresses through the eight stages, the instructional focus progresses from a teacher-centered to a learner-centered orientation (Moersch, 1997). The use of technology also shows a progression from an emphasis on isolated uses such as drill and practice applications to “an expanded view of technology as a process, product, and tool to augment and enhance students’ critical thinking and help them find viable solutions to real world problems” (Learning Quest, 2003, p. 3). According to Learning Quest (2004a), the framework for the LoTi is aligned with state and national frameworks such as the Texas STaR Chart, Florida STaR Chart, and ISTE’s NETS and TSSA.

Development of the Level of Technology Implementation Questionnaire

The National Assessment of Educational Progress (NAEP) found in 1998 that students of “eighth grade teachers who used computers for higher order thinking performed had students better on the NAEP than students whose teachers did not” (Learning Quest, 2003, p. 6). According to research, the most important element in promoting higher order thinking of students still point to the teacher’s role in the instructional planning process. Curricula that engages students in meaningful ways is essential to student demonstration of higher order thinking.

The Level of Technology Implementation Framework and its eight stages of growth with technology was later formed into a teacher technology survey known as the Level of Technology

Implementation Questionnaire or LoTiQ (Moersch, 2002). The LoTiQ was created to assess classroom practices tied to higher order thinking skills. The LoTiQ assists decision-makers in determining how school building level stakeholders (teachers, administrators, technology specialists) are either implementing or supporting the use of technology associated with influential teaching or learning opportunities directed at student achievement (Learning Quest, 2003). Six versions of the LoTiQ based on the nationally validated Levels of Technology Implementation (LoTi) framework are now available either on paper or on-line averaging around 20 minutes to administer. The six versions are: Pre-service Teacher, In-service Teacher, Instructional Specialist, Media Specialist, Administrator, and Higher Education Faculty. According to Moersch (1999, ¶ 4), the LoTiQ is designed to generate a profile across three domains detailing the level of an educator's implementation: LoTi, personal computer use (PCU), and current instructional practices (CIP). The PCU profile evaluates the individual educator's comfort and proficiency level using software application programs and troubleshooting simple hardware problems. An explanation of each intensity level is located in Appendix C. An educator's preference for instructional practices that are consistent with a learner-based curriculum design are identified using the CIP profile. An explanation of each intensity level is located in Appendix D.

The LoTiQ uses a Likert scale ranging from 0 to 7. The "0" is used to mark a "N/A" or Not Applicable response. Providing participants a "N/A" response in a column next to the Likert scale is a good way to accommodate for not applicable responses (Hill, 2001). Questions 6, 20, 32, 41, and 50 contribute to the CIP score which ranges from zero to 35. Questions 13, 15, 18, 26, and 49 contribute to the PCU score which ranges from zero to 35. The remaining questions contribute to the LoTi score which represent the eight levels of technology implementation with each level receiving a score ranging from zero to 35 (Learning Quest, 2004b). After scores are summed and divided by five for each of the eight LoTi levels, PCU and CIP, the raw scores are then graphed to determine where each sample participant falls on a profile that ranges from "Not True of Me Now" to "Very True of Me Now" thus developing a profile for each sample participant that resembles a bar graph (Appendix E) (F. Saunders, personal communication, October 13, 2006). Information obtained from the bar graph is then used to find each participant's LoTi total score using the LoTi Calculation Key (Appendix F) (F. Saunders, personal communication).

The relationship between an educator's LoTi profile and CIP is important. As an educator progresses through the six stages of the LoTi framework, there is a corresponding change to the instructional curriculum with the instructional focus moving away from a teacher-centered to a learner-centered focus. The use of computers also shifts from only isolated used to "an expanded view of technology as a process, product, and tool to help students find viable solutions to real-world problems" (Moersch, 1999, ¶ 6). Based on an educator's PCU, CIP, and LoTi, specific follow-up interventions may be developed to meet each individual educator's current technology needs. According to Moersch, "research has found a statistically significant correlation among students' academic achievement, the amount of professional development, and a teacher's LoTi" (Moersch, ¶ 7).

Studies Using the Level of Technology Implementation Questionnaire

Decisions or recommendations made by a researcher at the conclusion of a research study based on a poorly designed instrument could prove to be worthless and even potentially damaging. Therefore, researchers must consider the reliability of the instrument(s) they are intending to use (Breakwell, Hammond, & Fife-Schaw, 2000). According to McMillan and Schumacher (1997),

> reliability refers to the consistency of measurement - the extent to which the results are similar over different forms of the same instrument or occasions of data collection. The goal of developing reliable measures is to minimize the influence on the scores of chance or other variables unrelated to the intent of the measure (p. 178).

Reliability coefficients express the accuracy of measurement and are an acceptable method of estimating the reliability of an instrument (McGrath, Jelinek, & Wochner, 1963). The reliability coefficient varies from .00 to .99. If the coefficient is high, closer to .99, the instrument has little error and is highly reliable. However, is the coefficient is low, closer to .00, the instrument is non-reliable (McMillan & Schumacher).

Formal reliability estimates were established in 2000. The LoTi instrument established internal consistency using Cronbach's alpha on the LoTi, PCU, and CIP components at r = .7427, .8148, and .7353 respectively. Cronbach's alpha (α) is a widely used method for computing test score reliability especially in the area of educational and psychological research (Gall, Gall, & Borg, 2003; Gloeckner, Gliner, Tochterman, & Morgan, 2001). This research study established internal consistency using Cronbach's alpha on the LoTi, PCU, and CIP components at r = .917, .767, and .737 respectively. Cronbach's alpha is very adaptable because of its use with instruments made up of items that contain multiple choices such as a Likert scale (Gloeckner et al.; Huck, 2004). An example of this would be the LoTi Questionnaire that consists of a Likert type response format assessing the respondents' attitudes. Additional factor analysis revealed LoTi levels to be significantly correlated to Personal Computer Use (PCU) (r = .579) and also Stages of Instructional Practice (CIP) (r = .422) (Learning Quest, 2004a).

Approaches have been developed by measurement experts to estimate test score reliability. One method of estimating test score reliability is alternate-form reliability (Gall et al., 2003). This method examines a particular form of the test. To estimate errors, the correlation coefficient, coefficient of equivalence, is computed between individuals' scores on two equivalent forms of the same test. The tests may be administered during a single sitting or after a designated interval. This method of computing reliability errors is not used often because of the time and expense involved in creating alternate forms of a test (Gall et al.). Another method used to estimate test score reliability is test-retest reliability (Gall et al.). This method requires examination of the test administration. To estimate errors, the correlation coefficient, coefficient of stability, is computed between individuals' scores on the same test administered on two different testing occasions. This is the most common form of reliability testing for tests that do not have alternative forms available (Gall et al.).

Even though an instrument is determined to be reliable, validity of that instrument must also be considered (Breakwell et al., 2000). According to McGrath et al. (1963), validity is defined as "whether or not the item measures what it purports to measure" (p. 109). Two types of design validity are present in quantitative research. Internal validity is concerned with accurately concluding that an independent variable is accountable for deviations in the dependent variable (Kirk, 1995; McMillan & Schumacher, 1997). External validity refers to the ability of the researcher to generalize the research findings to other people and settings (Kirk; McMillan & Schumacher).

Initial validity studies were conducted in August 1997 and again in June 1998 (Learning Quest, 2004a). The focus of this research was to determine "How accurate are inferences about a person's Level of Technology Implementation likely to be when these inferences are based on the LoTiQ data" (Learning Quest). This question was answered by professional members assessing a person's level of technology implementation by conducting informal interviews with teachers. A LoTi level was estimated for each teacher interviewed. Actual LoTi scores were evaluated based on the LoTiQ instrument. This procedure provided researchers quantitative ratings on the person's LoTi level prior to exposure to LoTi scores. Additional factor analysis showed strong correlations between the estimated LoTi levels (based on interviews) and actual LoTi scores (based on LoTiQ) during the August 1997 and June 1998 pilot studies.

States such as Georgia, Kansas, Maryland, New Hampshire, Tennessee, and Virginia (*Summary of Framework Questionnaire*, 2002) have adopted the LoTi Questionnaire as their tool to evaluate their efforts toward improving instructional practices (Learning Quest, 2004a). Based on the *Summary of Framework Questionnaire*, states obtain information regarding: the impact of educational technology programs on student achievement and also a greater awareness of the impact of grant programs. In specific state reports prepared by Learning Quest (2003) such as the *New Hampshire Technology Use Profile*, results specific to that state are presented based on results of the LoTi Questionnaire. Bar graphs are presented in the report depicting the total PCU, CIP, and LoTi for the educators completing the LoTi Questionnaire.

A study conducted by Middleton and Murray (1999), used the LoTi Questionnaire to determine how the levels of technology implementation of fourth and fifth grade teachers affected student achievement in reading and mathematics. A sample of 107 fourth and fifth grade teachers and 2,574 students were included in the study. Based on responses, teachers were categorized as those showing high levels of use compared to those with little or no technology use in the classroom. After levels of technology implementation were identified, standardized test scores for students were compared using a one-way ANOVA to determine if there was a significant difference between the academic achievements of high level teachers' students compared to academic achievement of little or no technology use teachers' students. Based on the research, student achievement was impacted by the level of technology used by the teacher. Fifth grade teachers reported a higher level of technology use compared to fourth grade teachers. The Cronbach Alpha Test of Reliability was established at the .870 level. Results of this study indicated that student achievement was affected by the level of technology used by the classroom teacher (Middleton & Murray).

A large scale research study was conducted nationwide during the 2002-2003 school year using the LoTiQ (Learning Quest, 2003). A total of 32,560 educators completed the survey. Findings from the study concluded that 9% of the nation's educators self-assessed themselves at the Target Technology Level as defined by the National Education Technology Standards (NETS) and Technology Standards for School Administrators (TSSA). The Target Technology Level is met when technology in incorporated into challenging, engaging learning experiences that promote problem-solving, critical thinking, and self-directed learning (Learning Quest). Sixty-seven percent of respondents ranked themselves in Nonuse through Exploration, the lower portion of the LoTi Framework. Although 99% of respondents indicated having access to instructional computers for teachers and students, only 67% of educators felt comfortable using computers at home and in the workplace. Media/Technology Specialists and Administrators ranked themselves at Awareness and Exploration which be a possible explanation for lack of teachers not at the Target Technology Level (Integration [Routine] and above). Educators at Infusion and above had a higher percentage of participants who had received 25 or more hours of technology training. The survey also revealed that 88% of the respondents used the computer daily compared to 33% for student daily use (Learning Quest).

Since its creation, the LoTiQ has also been used in doctoral dissertations (Learning Quest, 2004a). A study conducted by Larson (Learning Quest, 2006) examined the usefulness of a technology mentoring program at a large California State University designed to help faculty integrate technology into teacher education courses. Larson's study used descriptive research with a qualitative case study approach along with data sources that included the LoTi Questionnaire's total score with a Cronbach's Alpha = .85. Seven themes resulted from Larson's study. Some of the themes recognized included: (a) mentees faced three major challenges when integrating technology: time, fear, and technology problems; (b) mentor and mentee relationships helped develop a community of practice; and (c) the number one integration strategy was working on an interest-based project (Learning Quest, 2006).

In a study conducted by Criscione (2005), the LoTiQ was used to assess technology integration levels of teachers based on participation versus non-participation in Title III Technology Literacy Challenge Fund courses. Results indicated that participation in the Title III Technology Literacy Challenge Fund courses did have an impact on technology implementation in the classroom (Technology Literacy Challenge, 1996).

Factors Influencing the Use of Technology in Instruction

Consideration should be made regarding demographic factors such as method of completing the technology requirement, certification field, grade level, age, and gender when developing technology professional development programs. Comparing teachers' concerns with demographic factors such as "age, sex, years of experience, and cycles of experience with the innovation…can lead to further explanations and interpretations of concerns data" (Hall, George, & Rutherford, 1986, p. 52). Demographic information is valuable to researchers because it identifies groups of individuals who are both identifiable and behave in similar ways (Alreck & Settle, 1995).

Factors that impact an educator's level of technology implementation identified in previous studies include: method of completing a technology requirement (Criscione, 2005; Sheumaker et al., 2001), certification field (Barron et al., 2003; Becker, 2001; Hanks, 2002), grade level (Barron et al.; Becker; Bebell et al., 2004; Hanks; McCannon & Crews, 2000), age (Baack & Brown, 1991; Czaja et al., 2006; DeOllos & Morris, 2003; Morris, 1989), and gender (Broos, 2005; Correll, 2001; Craig, 1999; Hargittai & Shafer, 2006; van et al., 2004). Attempts have been made through previous research studies (Barron et al.; Criscione; Hanks; Johnson, 2006; McCannon & Crews; Middleton & Murray, 1999) to find common variables of teachers regarding their technology implementation. Comfort levels and attitudes among teachers vary greatly with regard to their use of technology. While some teachers make the transfer from traditional teaching methods to computer-based ones effortlessly, others experience differing degrees of resistance corresponding to the stress levels they experience as they adjust to technology. If teachers are to make adjustments in their teaching methods to accommodate the inclusion of technology, school administrators must exhibit patience and support in the form of technology-professional development (Dawson & Rakes, 2003; Zucker et al., 2000).

The method of completing the technology requirement for recertification has been found to impact an educator's level of technology implementation. Sheumaker et al. (2001) conducted a study regarding Georgia's InTech program, a constructivist-based technology training program used to meet the technology requirement for recertification. Results of their study indicated that teachers who received technology training in an InTech classroom had higher perceived levels of technology integration than individuals who participated in an InTech redelivery method at the local schools or individuals who received no InTech training. In a study conducted by Criscione (2005), the LoTiQ was used to assess technology integration levels of teachers based on participation versus non-participation in Title III Technology Literacy Challenge Fund courses. Results indicated that participation in the Title III Technology Literacy Challenge Fund courses did have an impact on technology implementation in the classroom (Technology Literacy Challenge, 1996).

In a research study of technology in K-12 schools of one of the nation's largest school districts comparisons were made across subject areas (English, mathematics, science, and social studies). Only responses for middle and high school teachers were evaluated with regards to subject area differences. With regards to differences among subject areas, science teachers the most likely to integrate computers as a research tool (Barron et al., 2003). In a 1998 study conducted by the Center for Research and Information Technology Organizations, technology integration within subject areas was examined (Barron et al.; Hanks, 2002). Results of this study concluded that students in self-contained elementary school classes or in technology-related courses in high school were more likely to use technology. A study conducted by Hanks examined environmental and personal factors effecting K-12 teacher utilization of technology. Subject area taught was determined to be significantly related to the amount of instructional technology use in the classroom. Core subject area teachers (English, mathematics, science, and social studies) stated that whole-group instruction as the primary focus versus drill and practice for elementary school teachers. According to Forster (2006), technology applications that assist in the transformation or translation of information entered by the user have shown to assist mathematics curriculum. However, high school technology-related courses reported the highest technology use if included in the survey of subject areas (Becker, 2001).

In a research study of technology in K-12 schools of one of the nation's largest school districts, comparisons were made across grade levels. When teachers' integration of computers in the classrooms were compared across grade levels, elementary school teachers were more likely to use computers as a problem-solving or communication tool than middle or high school teachers (Barron et al., 2003). McCannon and Crews (2000) found that elementary technology professional development courses were catered towards administrative tasks such as word processing rather than curriculum integration, presentation software, and research. Bebell et al. (2004) reported that elementary teachers used technology more frequently to accentuate lessons and ask students to use technology more often in the classroom than middle and high school teachers. Middle and high school teachers reported using technology more frequently for grading purposes than elementary teachers (McCannon & Crews).

Research has also revealed a relationship between age and negative attitudes towards computers (DeOllos & Morris, 2003; Morris, 1989). In a study conducted by Czaja et al. (2006), results indicated that older adults were using technology at an increasing rate. However, older adults had more difficulty than younger adults when learning to use and operate current technologies such as computers and the Internet. Baack and Brown (1991) concluded that unless older adults understood the benefits of acquiring new technology skills older adults would have little motivation to learn.

Hargittai and Shafer (2006) conducted a study regarding differences in actual and perceived online skills with regards to gender. Results from that study indicated a significant difference with regards to gender and self-perceived skill levels. Women were more likely to lack confidence in themselves when it came to self-perception of their online skills. Literature regarding gender differences, performance, and computers showed that females viewed

computers as a male-oriented activity (Correll, 2001; Craig, 1999; Hargittai & Shafer). In a study conducted by Broos (2005), males were found to have less computer anxiety than females. Females also experienced more negative attitudes towards computers and the Internet.
van Braak et al. (2004), also concluded from their study that gender did have a significant impact on classroom use of computers with males integrating computers more often.

The first independent variable used in this study was method of completing the technology requirement for recertification. Participants chose (a) test out portfolio, (b) ITT course, (c) AssessOnline test, (d) Other, and (e) None (I have not completed the technology requirement for recertification. Options 1 through 3 were choices specific to educators in this large public school system to meet the technology requirement for recertification through HB1187 (GCPS, 2001, 2006b; Georgia Legislature, 2000). Sheumaker et al. (2001) conducted a study regarding Georgia’s InTech program, a constructivist-based technology training program used to meet the technology requirement for recertification. Results of their study indicated that teachers who received technology training in an InTech classroom had higher perceived levels of technology integration than individuals who participated in an InTech redelivery method at the local schools or individuals who received no InTech training. In a study conducted by Criscione (2005) the LoTiQ was used to assess technology integration levels of teachers based on participation versus non-participation in Title III Technology Literacy Challenge Fund courses. Results indicated that participation in the Title III Technology Literacy Challenge Fund courses did have an impact on technology implementation in the classroom (Technology Literacy Challenge, 1996). For data analysis, respondents were divided into two groups: ITT participants and non-ITT participants. The two newly constructed variables were dichotomous and were directly entered into the regression model.

The second independent variable used in this study was certification field. This study was specific to a large public school system in Georgia. The PSC dictates the requirements for certification in Georgia. Therefore, certification fields were listed as they were with the PSC (Appendix G) (PSC, 2006). In a research study of technology in K-12 schools of one of the nation's largest school districts comparisons were made across subject areas (English, mathematics, science, and social studies). Only responses for middle and high school teachers were evaluated with regards to subject area differences. With regards to differences among subject areas, science teachers were the most likely to integrate computers as a research tool (Barron et al., 2003). In a 1998 study conducted by the Center for Research and Information Technology Organizations, technology integration within subject areas was examined (Barron et al.). Results of this study concluded that students in self-contained elementary school classes or in technology-related courses in high school were more likely to use technology. According to Forster (2006), technology applications that assist in the transformation or translation of information entered by the user have shown to assist mathematics curriculum. For data analysis, respondent were divided into two groups: those who taught in fields generally thought of as using higher levels of technology skills (Science, Mathematics, and Technology Education) and those who taught in fields generally thought of as using fewer levels of technology skills (Humanities, Elementary Education, PE, and other electives). The two newly constructed variables were dichotomous and were directly entered into the regression model.

The third independent variable used in this study was grade level teaching assignment. The five categories that were used in the demographic section of the LoTiQ survey for this research study: elementary school, middle school, high school, multiple grade levels, and all grade levels (K-12) were based on grade level teaching assignments identified by Learning Quest

(2006). In a research study of technology in K-12 schools of one of the nation's largest school districts, comparisons were made across grade levels. When teachers' integration of computers in the classrooms was compared across grade levels, elementary school teachers were more likely to use computers as a problem-solving or communication tool than middle or high school teachers (Barron et al., 2003). McCannon and Crews (2000) found that elementary technology professional development courses were catered towards administrative tasks such as word processing rather than curriculum integration, presentation software, and research. Bebell et al. (2004) report that elementary teachers use technology more frequently to accentuate lessons and asked students to use technology more often in the classroom than middle and high school teachers. Middle and high school teachers reported using technology more frequently for grading purposes than elementary teachers. For data analysis, respondent were divided into two groups: Elementary and Secondary. The two newly constructed variables were dichotomous and were directly entered into the regression model.

The fourth independent variable used in this study was age. Each participant gave his or her age based on his or her last birthday. Research has revealed a relationship between age and negative attitudes towards computers (DeOllos & Morris, 2003; Morris, 1989). In research conducted by DeOllos and Morris and Hardy (1998), a direct link was found between age and computer attitudes that indicated as age increased so did negative attitudes toward computers. According to Loyd and Gressard (1984), developmental and socialization characteristics of various age groups might play a role in openness to computer-related instruction.

The fifth independent variable used in this study was gender. Participants chose either male or female. Gender has often been included as a demographic variable is research studies (Alreck & Settle, 1995; Creswell, 1994). Gender must be considered as a possible factor in computer attitudes (Hardy, 1998). Several non-empirical observations have claimed that females were more likely to exhibit computer anxiety. Hargittai and Shafer (2006) conducted a study regarding differences in actual and perceived online skills with regards to gender. Results from that study indicated a significant difference with regards to gender and self-perceived skill levels. Women were more likely to lack confidence in themselves when it came to self-perception of their online skills (Correll 2001; Craig 1999; Hargittai & Shafer). For data analysis, respondent were divided into two groups: Male and Female. The two newly constructed variables were dichotomous and were directly entered into the regression model.

Impact of Technology in Education

According to Darling-Hammond (1997), to progress from isolated efforts to a revitalized educational system, promising initiatives that include a logical set of policies linked to educational goals must be supported by a teacher development system. Critical to a teacher development system is the redesign of teacher education and professional development. Teacher education and professional development programs should be catered around standards for student learning and for excellence in teaching practice (Darling-Hammond; Hamsa, 1998; Wise, 1996). One strategy for creating a greater cohesiveness between theory and practice is the development of technological skills that support student and teacher learning in the information age (Darling-Hammond; Zucker et al., 2000). Computer technology is assisting educators with developing instructional practices that contextualize learning, motivate students, and individualize instruction thereby increasing the number of students reaching mastery levels of achievement (Education Commission of the States, 2005). Students learn more and at a quicker pace with computer assisted instruction because they have more control over their own learning that is combined with the ability to develop analytical and critical thinking skills.

Another impact of technology on teachers use is the growing concern from local, state, and national leaders regarding teachers' technology competencies (Burke, 2000; Georgia Legislature, 2000; Kentucky Department of Education, 2006; South Carolina Department of Education, 2006; Texas Education Agency, 2004; U.S. Department of Education, 2006; Virginia Department of Education, 2006). This concern has led to mandating technology training for educators. To prepare teachers to integrate technology, student learning, and academic goals, technology-professional development programs were created. The goal of these programs is to provide a channel for significant changes in the teaching and learning process of technology (Sheumaker et al., 2001).

Summary of Related Literature

For professional development to critically impact education, increased attention must be given to its association to program adoption and implementation. A process must be developed by which needs become objectives and objectives become programs thus encouraging the growth of those responsible for meeting the diverse responsibilities and learners for whom they are accountable (Gall & Vojtek, 1994). Technology-professional development programs became especially important after the release of various national reports and technology standards for teachers (Holmes Group, 1986; isteNETS, 2005; National Commission on Teaching and America's Future, 1996; Office of Technology Assessment, 1995). The principle guiding any quality technology-professional development program is that the curriculum drives the use of technology and not the other way around (Meltzer & Sherman, 1997). Empowered teachers will develop ways to include technology into their ongoing instruction rather than view it as an unconnected activity (Loucks-Horsley, 2000; Mouza, 2002). Compared to general professional development courses in areas such as classroom management, discipline, or methods to improve reading scores which are specifically targeted to classroom practice, technology-professional development is often a two-step process. Not only must teachers learn the specific technology being used but they must also understand how to effectively incorporate that technology into their curriculum (Brand, 1997; Bybee & Loucks-Horsley, 2000). The goal of technology-professional development is to help educators at all technology skill levels experience incorporating technology as a dynamic part of their curriculum.

The impact of teachers' use of technology is a growing concern for local, state, and national leaders (Burke, 2000). This concern has led to technology training reforms for educators to improve technology competencies in many states (Burke) including: Georgia (Georgia Legislature, 2000), Kentucky (Kentucky Department of Education, 2006), Texas (Texas Education Agency, 2004), South Carolina (South Carolina Department of Education, 2006), and Virginia (Virginia Department of Education, 2006).

In response to these reform movements, a large public school system in the state of Georgia developed three options for educators in that school system to choose from at the local public school system level (GCPS, 2001). The first option was to complete a test out. This option required the educator to sign a letter confirming his/her technology knowledge and skills and then independently completed an electronic portfolio meeting specified criteria. In addition, the educator was evaluated by his/her local school evaluating supervisor regarding on-the-job technology integration performance (GCPS, 2001). The second option was to complete a 50-hour training course, Instructional Technology for Teachers (ITT), offered through the major public school system in Georgia's Information Management Division. Course participants completed an electronic portfolio in addition to receiving an on-the-job technology integration performance evaluation by his/her local school evaluating supervisor. The course was offered at different school locations throughout the county and delivered by technology instructors previously approved by the state (GCPS, 2006b). The final option was the completion of the Georgia AssessOnline test. This was a proctored test that employees of this major school system in Georgia signed up for free of charge. After completing the online test, participants will receive a copy of their test score (GCPS, 2006b).

Building upon the work of the Concerns Based Adoption Model (Hall & Loucks, 1978b), the Apple Classrooms of Tomorrow research, and his own research, in 1995, Moersch developed the Levels of Technology Implementation (LoTi) framework in an effort to accurately measure authentic classroom technology use. The framework focuses on technology as an interactive learning tool that has the greatest and longest lasting impact on classroom learning yet is often the most difficult to implement and assess (Learning Quest, 2004b). Rather than evaluating how technology is used to accomplish isolated tasks, Moersch wanted to evaluate how technology was being integrated to support “purposeful problem-solving, performance-based assessment practices, and experiential learning-all characteristics of the ‘Target Technology’ level established by the CEO Forum on Education and Technology” (Learning Quest; Moersch, 2001).

The Level of Technology Implementation Framework and its eight stages of growth with technology was later formed into a teacher technology survey known as the Level of Technology Implementation Questionnaire or LoTiQ (Moersch, 2002). The LoTiQ was created to assess classroom practices tied to higher order thinking skills. The LoTiQ assists decision-makers in determining how school building level stakeholders (teachers, administrators, technology specialists) are either implementing or supporting the use of technology associated with influential teaching or learning opportunities directed at student achievement (Learning Quest, 2003).

Administrators, school systems, educational agencies and lawmakers are encouraging the use of instructional technology in the classroom and curriculum because of its positive effects on student achievement (Anderson, 2000; Scheidet, 2003). Computer technology is assisting educators with developing instructional practices that contextualize learning, motivate students, and individualize instruction thereby increasing the number of students reaching mastery levels of achievement (Education Commission of the States, 2005). Students learn more and at a quicker pace with computer assisted instruction because they have more control over their own learning that is combined with the ability to develop analytical and critical thinking skills. To assist in preparing teachers to integrate technology, student learning, and academic goals, technology-professional development programs are created. The goal of these programs is to provide a channel for significant changes in the teaching and learning process of technology (Sheumaker et al., 2001).

CHAPTER 3

METHODS AND PROCEDURES

Rationale

There is a high price tag for effectively incorporating technology into classroom instruction. Educational technology research is needed to help justify how and why those funds are well spent. This research is especially important to extinguish criticisms of the inconsistent impact and low usage of technology by educators regardless of type of training and access to resources (Roblyer & Knezek, 2003).

Teacher education and professional development programs should be catered around standards for student learning and for excellence in teaching practice (Darling-Hammond, 1997; Hamsa, 1998; Wise, 1996). One strategy for creating a greater cohesiveness between theory and practice is the creation of programs that develop technological skills that support student and teacher learning in the information age (Darling-Hammond). Findings from this study will provide technology-professional development leaders further insight on the impact of technology-professional development programs on educators across all grade levels. Findings from this research study could be used by professional development leaders and school and county administrators to develop technology training programs that are the most beneficial to instruction.

School systems are investing significant money to increase the availability of computers and other forms of technology for student and teacher use. Teachers must have the confidence to know when and how to use technology within instruction (Burke, 1998; Hardy, 1998; Office of Technology Assessment, 1995). Teacher education and professional development programs should be catered around standards for student learning and for excellence in teaching practice (Hamsa, 1998; Wise, 1996).

Reacting to this need for increased technology standards for teachers, a large public school system in Georgia established three options for their educators to meet the technology requirement for recertification which included: a test-out portfolio, ITT, and AssessOnline (GCPS, 2001, 2006b). To assist educators in making the decision of which program to choose, a website was created at http://www.gwinnett.k12.ga.us/gtat/ that provided an overview and general information on the three options and any necessary forms (GCPS, 2001, 2006b).

Building upon the Concerns Based Adoption Model and the Level of Technology Implementation Framework, the Level of Technology Implementation (LoTi) Questionnaire was created to assess classroom practices tied to higher order thinking skills (Moersch, 1997). The LoTi questionnaire assists decision-makers in determining how school building level stakeholders (teachers, administrators, technology specialists) are either implementing or supporting the use of technology associated with influential teaching or learning opportunities directed at student achievement (Learning Quest, 2003).

The results of this study have the potential to guide the creation of future technology-professional development programs. Consideration should be made regarding factors such as method of completing the technology requirement, certification field, grade level, age, and gender when developing technology professional development programs. Previous research has show differences regarding technology ease of use levels across factors such as: method of completing a technology requirement (Criscione, 2005; Sheumaker et al., 2001), certification field (Barron et al., 2003; Becker, 2001; Hanks, 2002), grade level (Barron et al.; Becker; Bebell et al., 2004; Hanks; McCannon & Crews, 2000), age (Baack & Brown, 1991; Czaja et al., 2006;

DeOllos & Morris, 2003; Morris, 1989), and gender (Broos, 2005; Correll, 2001; Craig, 1999; Hargittai & Shafer, 2006; van et al., 2004).

Purpose Statement and Research Questions

The purpose of this correlational study was to analyze the characteristics of educators in a large public school district in the state of Georgia to provide predictors of Personal Computer Use (PCU), Current Instructional Practices (CIP), Level of Technology Implementation (LoTi), and Level of Technology Implementation (LoTi) total score as measured by the Level of Technology Implementation Questionnaire (LoTiQ). Results of this study may contribute to the development of future technology professional development programs. The specific questions addressed in this study were:

Research Question One

What combination of method of completing the technology requirement for certification, certification field, grade level teaching assignment, age, and gender provided the best model for predicting educators' Personal Computer Use (PCU) scores?

Research Question Two

What combination of method of completing the technology requirement for certification, certification field, grade level teaching assignment, age, and gender provided the best model for predicting educators' Current Instructional Practices (CIP) scores?

Research Question Three

What combination of method of completing the technology requirement for certification, certification field, grade level teaching assignment, age, and gender provided the best model for predicting educators' Level of Technology Implementation (LoTi) scores?

Research Question Four

What combination of method of completing the technology requirement for certification, certification field, grade level teaching assignment, age, and gender provided the best model for predicting educators' Level of Technology Implementation (LoTi) total scores?

Design

A correlational research design was used for this study. The purpose of correlational studies is to discover relationships between variables (Gall et al., 2003). The researcher cannot determine causality from the results. The quality of correlational studies is determined by the depth of the rational and the theoretical framework that guides the design. Correlational studies are best used to measure the degree and direction of relationships. Advantages of using a correlational study include: (a) researchers are allowed to analyze relationships among a large number of variables in a single study and (b) information is provided concerning the degree of the relationships between the variables being studied (Gall et al.).

There were assumptions associated with this study. First, participants provided accurate and honest information regarding their technology use on the LoTi Questionnaire. Second, the researcher respected the anonymity of the participants and only reported data in aggregate. Finally, to assure accurate measurement, demographic questions included in the survey were clearly stated (Alreck & Settle, 1995) and participants responded appropriately to each question.

This study had several delimitations. First, the population of this study was limited to only certified teachers employed within a large public school system in the state of Georgia for the 2006-2007 school year. Results were not generalized beyond this group. Second, this correlational study cannot determine causality (Gall et al., 2003). Third, rather than an independent observer evaluating the teacher's level of technology implementation, the teacher evaluated his or her own level of technology use using the LoTi Questionnaire. Finally, there was no opportunity to collect longitudinal data to support the findings from this study.

Population and Sample

The population for this study was certified teachers in a large public school district in the state of Georgia employed during the 2006-2007 school year as identified by this school system's employment records. This population included elementary, middle, and high school teachers in all subject areas. No generalizations were made beyond this large public school system in Georgia. For this study, the population was of convenience to the researcher due to the researcher's employment location. During the spring of 2007, the researcher requested a list of names of certified teachers employed during the 2006-2007 school year from the school district's human resource department. The population for this study consisted of 11,932 certified teachers.

Sample Size

How a researcher selects a sample depends on the type of measurements needed, nature of the population being studied, complexity of the survey design, and resources available (Breakwell et al., 2000). A simple random sample was used for this study. According to Gall et al. (2003), a simple random sample is "a sample selected from a population by a process that provides every sample of a given size an equal probability of being selected" (p. 171). The primary advantage to using randomly selected samples is that they provide data that can be generalized to the larger population within margins of error that are determined by statistical formulas (Creswell, 1994; Gall et al.). Another advantage for using random sampling is that "it satisfies the logic by which a null hypothesis is tested using inferential statistics" (Gall et al., p. 171).

To meet the need for an efficient method of determining the sample size needed, Krejcie and Morgan (1970) provided the *Table for Determining Sample Size from a Given Population*. Krejcie and Morgan's *Table for Determining Sample Size from a Given Population* is "applicable to any defined population" (p. 607); therefore, it was used for this study. Based on Krejcie and Morgan's table, 375 participants were needed to meet the required sample size. However, in an attempt to meet this minimum number of sample participants, over sampling was used. Based on previous research, one method of over sampling was to double the original number of sample participants. Therefore, the number of participants included in the sample for this study was 750. A table of random numbers was used with the number seven being selected as the deciding factor for choosing participants. Names of teachers included in the population were listed alphabetically by last name and numbered sequentially. Every seventh educator was selected for the sample until 750 participants were chosen.

Instrumentation

The assessment instrument used for measuring the dependent variable in this research study was the LoTi Questionnaire. Permission to use the LoTi Questionnaire (Appendix H) was granted by Moersch, creator of the LoTiQ. According to Learning Quest (2003), the purpose for creating the LoTi Questionnaire was to assess classroom practices and their ties to higher order thinking skills and appropriate, thought-provoking curriculum. Through the use of the LoTi Questionnaire, decision-makers may determine how all administrators, technology specialists, classroom teachers, etc.) are implementing or supporting the use of technology; thereby, creating powerful teaching and learning environments.

<u>Level of Technology Implementation Questionnaire</u>

The teacher technology survey known as the Level of Technology Implementation Questionnaire or LoTiQ was developed based on the Level of Technology Implementation Framework and its eight stages of growth with technology (Moersch, 2002). The LoTiQ was created to assess classroom practices tied to higher order thinking skills. The LoTi questionnaire assists decision-makers in determining how school building level stakeholders (teachers, administrators, technology specialists) are either implementing or supporting the use of technology associated with influential teaching or learning opportunities (Learning Quest, 2003). Six versions of the LoTi questionnaire based on the nationally validated Levels of Technology Implementation (LoTi) scale are available either on paper or on-line averaging around 20 minutes to administer. The six versions are: Pre-service Teacher, In-service Teacher, Instructional Specialist, Media Specialist, Administrator, and Higher Education Faculty. Participants for this study included in-service teachers employed during the 2006-2007 school year in a large public school district in the state of Georgia. Therefore, the version of the LoTi instrument used was the LoTi Questionnaire version 5.0 for in-service teachers.

The use of surveys in research has advantages and disadvantages. Advantages of using a survey include low cost, ease of administering the data collection process, and the ability to reach samples that might otherwise be inaccessible to the researcher (Alreck & Settle, 1995; Creswell, 1994). Surveys are also the preferred method for collecting data when the participants are concerned about anonymity (Hill, 2001). There are some disadvantages also associated with surveys. The researcher is limited to the type of data that can be collected with a survey instrument. A survey that is too long or complex may also result in a low response rate. Respondents' attitudes towards questions could also negatively impact the success of the study.

Researchers should be careful regarding the wording of questions and that special terms are defined as to not bias the answers (Creswell; Hill).

According to Moersch (1999, ¶ 4), the LoTiQ was designed to generate a profile across three domains detailing the level of an educator's implementation: Levels of Technology Implementation (LoTi); personal computer use (PCU), which evaluates the individual educator's comfort and proficiency level using software application programs and troubleshooting simple hardware problems; and current instructional practices (CIP), which identifies an educator's preference for instructional practices that are consistent with a learner-based curriculum design. The LoTiQ uses a Likert scale ranging from 0 to 7. The "0" is used to mark a "N/A" or Not Applicable response. Providing participants a "N/A" response in a column next to the Likert scale is a good way to accommodate for not applicable responses (Hill, 2001). Questions 6, 20, 32, 41, and 50 contribute to the CIP score which ranges from zero to 35. Questions 13, 15, 18, 26, and 49 contribute to the PCU score which ranges from zero to 35. The remaining questions contribute to the LoTi score which represent the eight levels of technology implementation with each level receiving a score ranging from zero to 35 (Learning Quest, 2006). After scores are summed and divided by five for each of the eight LoTi levels, PCU and CIP, the raw scores for each LoTi level, CIP, and PCU are then graphed to determine where each sample participant falls on a profile that ranges from "Not True of Me Now" to "Very True of Me Now" thus developing a profile for each sample participant that resembles a bar graph. (Learning Quest) (Appendix E). Information obtained from the bar graph is then used to find each participant's LoTi total score using the LoTi Calculation Key (Appendix F) (Learning Quest).

The relationship between an educator's LoTi profile and CIP is important. As an educator progresses through the six stages of the LoTi framework, there is a corresponding change to the instructional curriculum with the instructional focus moving away from a teacher-centered to a learner-centered focus. The use of computers also shifts from only isolated used to "an expanded view of technology as a process, product, and tool to help students find viable solutions to real-world problems" (Moersch, 1999, ¶ 6). Based on an educator's LoTi, PCU, and CIP, specific follow-up interventions may be developed to meet each individual educator's current technology needs (Moersch).

Formal instrument development procedures of the Level of Implementation (LoTi) questionnaire were begun in March 1997 by Moersch to accurately assess the level of technology implementation of educators (Learning Quest, 2004a). The questionnaire contains fifty items that assess three areas: Level of Technology Implementation (LoTi), Current Instructional Practices (CIP), and Personal Computer Use (PCU). The Level of Technology Implementation (LoTi) survey questions approximate the degree each participant is implementing technology (classroom teacher) or modeling/supporting the implementation of technology (administrator, technology specialists). The Personal Computer Use (PCU) survey questions measure each participant's comfort and proficiency level of computer use. The Current Instructional Practices (CIP) survey questions expose each participant's tendency toward instructional practices consistent with either a subject-matter or learner-based curriculum design (Learning Quest, 2003).

By completing the LoTi Questionnaire, classroom teachers, technology specialists, administrators, etc. receive a LoTi profile. This LoTi Profile identifies the specific level of technology implementation for each questionnaire participant (Appendix B). Levels range from Nonuse to Refinement. Observed changes to the instructional curriculum occur as each respondent progresses from one level to the next of the LoTi framework. As participants reach a higher level of implementation, their instructional focus is shifting from a teacher-centered to a more learner-centered orientation. The use of computers is also progressing from an isolated use to a more inclusive use that increases and enhances students' critical thinking (Learning Quest, 2003).

The questionnaire was delivered in a posttest only format to the sample group. According to Black (1999), a limitation to this post-test only method is that this type of study does not confirm or deny a hypothesis. There is no direct control over the independent variables being studied. However, the validity of the independent variables can be guaranteed through quality sampling methods. A portion of the questionnaire included demographic questions. These questions were included at the end of the LoTi Questionnaire. According to Hill (2001), it is important to include these types of questions at the end of the survey. Questions placed at the beginning of a survey instrument may distract a participant's attention from the survey items that require careful consideration. Demographic questions could also sensitize participants to particular questions. Also, should a participant become fatigued as he or she completes the survey, the placement of demographic questions at the end requires less thinking (Hill).

Reliability

Decisions or recommendations made by a researcher at the conclusion of a research study based on a poorly designed instrument could prove to be worthless and even potentially damaging. Therefore, researchers must consider the reliability of the instrument(s) they are intending to use (Breakwell et al., 2000). According to McMillan and Schumacher (1997),

> reliability refers to the consistency of measurement - the extent to which the results are similar over different forms of the same instrument or occasions of data collection. The

> goal of developing reliable measures is to minimize the influence on the scores of chance or other variables unrelated to the intent of the measure (p. 178).

Reliability coefficients express the accuracy of measurement and are an acceptable method of estimating the reliability of an instrument (McGrath et al., 1963). The reliability coefficient varies from .00 to .99. If the coefficient is high, closer to .99, the instrument has little error and is highly reliable. However, if the coefficient is low, closer to .00, the instrument is non-reliable (McMillan & Schumacher).

Formal reliability estimates were established in 2000. The LoTi instrument established internal consistency using Cronbach's alpha on the LoTi, PCU, and CIP components at r = .7427, .8148, and .7353 respectively. Cronbach's alpha (α) is a widely used method for computing test score reliability especially in the area of educational and psychological research (Gall et al., 2003; Gloeckner et al., 2001). Cronbach's alpha is very adaptable because of its use with instruments made up of items that contain multiple choices such as a Likert scale (Gloeckner et al.; Huck, 2004). This research study established internal consistency using Cronbach's alpha on the LoTi, PCU, and CIP components at r = .917, .767, and .737 respectively. An example of this would be the LoTi Questionnaire that consists of a Likert type response format assessing the respondents' attitudes. Additional factor analysis revealed LoTi levels to be significantly correlated to Personal Computer Use (PCU) (r = .579) and also Current Instructional Practice (CIP) (r = .422) (Learning Quest, 2004a).

Approaches have been developed by measurement experts to estimate test score reliability. One method of estimating test score reliability is alternate-form reliability (Gall et al., 2003). This method examines a particular form of the test. To estimate errors, the correlation coefficient, coefficient of equivalence, is computed between individuals' scores on two equivalent forms of the same test. The tests may be administered during a single sitting or after a designated interval. This method of computing reliability errors is not used often because of the time and expense involved in creating alternate forms of a test (Gall et al.). Another method used to estimate test score reliability is test-retest reliability (Gall et al.). This method requires examination of the test administration. To estimate errors, the correlation coefficient, coefficient of stability, is computed between individuals' scores on the same test administered on two different testing occasions. This is the most common form of reliability testing for tests that do not have alternative forms available (Gall et al.).

Validity

Even though an instrument is determined to be reliable, validity of that instrument must also be considered (Breakwell et al., 2000). According to McGrath et al. (1963), validity is defined as "whether or not the item measures what it purports to measure" (p. 109). Two types of design validity are present in quantitative research. Internal validity is concerned with accurately concluding that an independent variable is accountable for deviations in the dependent variable (Kirk, 1995; McMillan & Schumacher, 1997). External validity refers to the ability of the researcher to generalize the research findings to other people and settings (Kirk; McMillan & Schumacher).

Initial validity studies were conducted in August 1997 and again in June 1998. The focus of this research was to determine how accurate inferences regarding an individual's Level of Technology Implementation are based on the LoTiQ data collected (Learning Quest, 2004a). This question was answered by professional members assessing a person's level of technology implementation by conducting informal interviews with teachers. A LoTi level was estimated for each teacher interviewed. Actual LoTi scores were evaluated based on the LoTiQ instrument.

This procedure provided researchers quantitative ratings on the person's LoTi level prior to exposure to LoTi scores. Additional factor analysis showed strong correlations between the estimated LoTi levels (based on interviews) and actual LoTi scores (based on LoTiQ) during the August 1997 and June 1998 pilot studies.

Procedure

Permission to conduct this study was obtained from the University of Georgia Institutional Review Board (UGA IRB) (Appendix I) along with the Board of Education for the major public school system in Georgia (Appendix J) being studied prior to implementation. To insure confidentiality, all participants were assigned an identification number. Names of participants were not included on questionnaires and data was reported in aggregate only. To facilitate follow-up procedures, a master list of identifiers which linked the participant's name to the number on the questionnaire was maintained during the collection period. The master list was destroyed at the conclusion of the data collection.

Survey packets were mailed through the school system's courier to all members of the sample population on Tuesday, March 20, 2007 (Dillman, 1978). Packets reached the participants' schools on Wednesday, March 21, 2007. All subsequent mailings were conducted on a Tuesday to be received by participants on a Wednesday. The following items were included in the research packet: a cover letter describing the study and assuring confidentiality (Appendix K), the LoTi Questionnaire with directions and demographic questions included (Appendix L), and a self addressed courier envelope. The questionnaires were numbered in the lower right corner of the first page beginning with one to track non-respondents. A return due date for the completed surveys was noted in bold. A due date of ten days from anticipated time of receipt was noted in the directions for completing the survey (Hill, 2001).

Dillman (1978) recommends follow-up procedures that include three timed mailings one week, three weeks, and seven weeks after the original mail-out. After one week from the original mail date, a postcard follow-up was sent to all recipients of the first mailing (Appendix M). These postcards were written as a thank you for those who had already returned their questionnaires and as a reminder for those who had not (Dillman). After three weeks from the original mail date, 605 nonrespondents were sent a second packet consisting of a follow-up cover letter (Appendix N), a replacement questionnaire, and a self-addressed courier envelope (Dillman). After seven weeks from the original mail date, a third packet consisting of a follow-up cover letter (Appendix O), a replacement questionnaire, and a self-addressed courier envelope were sent to 393 nonrespondents (Dillman). Nine weeks after the first packets were mailed, data collection ended and data analysis began. Three hundred and eighty-seven surveys were returned resulting in a return rate of 52% (387/750). Of the 387 surveys returned, seven questionnaires were returned incomplete and 15 were returned due to the participants' election to withdraw from the study. The 365 usable questionnaires provided for a response rate of 50% (365/728).

Nonresponse Error

The one of the greatest obstacles faced by researchers using questionnaires is low response rates (Berdie, Anderson, & Niebuhr, 1986). Nonresponse error is a severe source of bias (Beride et al.; Krueger, 2001; Moore, 2000). Survey response rates may be calculated by dividing the sum of all survey questionnaires received by the number of individuals in the sample. This number would be calculated after all successful mailings and reminders have been conducted (Dillman, 1978; Krueger). According to Colombo (2000), response rates from mail surveys are declining to around 20 percent.

Using information from only sample participants who choose to respond introduces nonresponse error (Miller & Smith, 1983). A strategy researchers may use to control the nonresponse error requires getting back as many questionnaires as possible (Miller & Smith). Researchers should follow established guidelines regarding creating cover letters and questionnaires (Dillman, 1978). Researchers should also establish follow-up procedures that will encourage participant response. Postcards and subsequent mailings are successful methods for increasing response rates (Dillman; Miller & Smith). Other techniques that will increase response rates include: mailing the questionnaire so that it arrives at a less busy time, assuring confidentiality, and specifying in the cover letter a deadline date to receive a response (Dillman; Miller & Smith).

After all follow-up efforts have been used, the researcher must take nonrespondents into consideration and maintain evidence that the results are true for the sample. Previous research has shown that nonrespondents are often similar to late respondents (Miller & Smith, 1983). Respondents may be separated into two groups: those who respond early and those who respond late. The two groups are compared to determine if any statistical differences are present between the two groups. "With late respondents assumed typical of nonrespondents, if no differences are found, then respondents are generalized to the sample" (Miller & Smith, p. 48). The desired number of respondents according the Krejcie and Morgan's (1970) *Table for Determining Sample Size from a Given Population* was 375. After non respondents and incomplete surveys were removed, 365 usable surveys remained which resulted in the number of surveys being ten below the desired number. However, using an independent t-test to compare the total LoTi scores of early respondents to late, it was determined that the p-value was .520. Therefore, the difference between the two means was not statistically significant at the 5% level of significance.

Sampling Error

For the purpose of a survey, a sample may be defined as a set of respondents selected from a larger population (Mugo, 1999). This sample should mirror the population. However, when a sample is unrepresentative of the population, one of the most common causes is sampling error (Mugo). According to Gall et al. (2003), a sampling error is the difference of a sample statistic from its population value. Two situations may result in a sampling error, chance and sampling bias. Chance occurs when an unusually large number of individuals are chosen for a sample who are not representative of the population. Using a large enough sample is the primary protection against this type of error. The second type of sampling error, sampling bias, is primarily the result of a poor sampling plan due to the researcher favoring the selection of participants who have specific characteristics (Mugo). The primary protection against sampling error is the use of a random sample where all members of the population have an equal chance of being selected for the sample (Gall et al.; Mugo).

Data Analysis

The LoTi Questionnaire (Appendix L) contains 50 questions that assists decision-makers in determining how school building level stakeholders (teachers, administrators, technology specialists) are either implementing or supporting the use of technology associated with influential teaching or learning opportunities (F. Saunders, personal communication, October 13, 2006). According to Moersch (1999, ¶ 4), the LoTi Questionnaire is designed to generate a profile across three domains detailing the level of an educator's implementation with regards to: Levels of Technology Implementation (LoTi); personal computer use (PCU), which evaluates the individual educator's comfort and proficiency level using software application programs and troubleshooting simple hardware problems; and current instructional practices (CIP), which identifies an educator's preference for instructional practices that are consistent with a learner-based curriculum design . The LoTiQ uses a Likert scale ranging from 0 to 7. The "0" is used to mark a "N/A" or Not Applicable response. Providing participants a "N/A" response in a column next to the Likert scale is a good way to accommodate for not applicable responses (Hill, 2001). The questionnaire consisted of 50 questions: five questions for each of the eight Levels of Technology Implementation (LoTi), five questions for the levels of Personal Computer Use (PCU), and five questions for the level of Current Instructional Practice (CIP). After scores were summed and divided by five for each of the eight LoTi levels, PCU and CIP, the raw scores for each LoTi level, CIP, and PCU were then graphed to determine where each sample participant fell on a profile that ranged from "Not True of Me Now" to "Very True of Me Now" thus developing a profile for each sample participant that resembled a bar graph. (Learning Quest, 2006). Information obtained from the bar graph was then used to find each participant's LoTi total score using the LoTi Calculation Key (Appendix F) (Learning Quest).

Treatment of Independent Variables

Demographic variables such as method of completing the technology requirement for recertification, certification field, grade level, age, and gender are valuable to researchers because they identify groups of individuals who are both identifiable and behave in similar ways (Alreck & Settle, 1995).

The first independent variable used in this study was method of completing the technology requirement for recertification. Participants chose (a) test out portfolio, (b) ITT course, (c) AssessOnline test, (d) Other, and (e) None (I have not completed the technology requirement for recertification. Options 1 through 3 were choices specific to educators in this large public school system to meet the technology requirement for recertification through

HB1187 (GCPS, 2001, 2006b; Georgia Legislature, 2000). Sheumaker et al. (2001) conducted a study regarding Georgia's InTech program, a constructivist-based technology training program used to meet the technology requirement for recertification. Results of their study indicated that teachers who received technology training in an InTech classroom had higher perceived levels of technology integration than individuals who participated in an InTech redelivery method at the local schools or individuals who received no InTech training. In a study conducted by Criscione (2005), the LoTiQ was used to assess technology integration levels of teachers based on participation versus non-participation in Title III Technology Literacy Challenge Fund courses. Results indicated that participation in the Title III Technology Literacy Challenge Fund courses did have an impact on technology implementation in the classroom (Technology Literacy Challenge, 1996). For data analysis, respondents were divided into two groups: ITT participants and non-ITT participants. The two newly constructed variables were dichotomous and were directly entered into the regression model.

The second independent variable used in this study was certification field. This study was specific to a large public school system in Georgia. The PSC dictates the requirements for certification in Georgia. Therefore, certification fields were listed as they were with the PSC (Appendix G) (PSC, 2006). In a research study of technology in K-12 schools of one of the nation's largest school districts, comparisons were made across subject areas (English, mathematics, science, and social studies). Only responses for middle and high school teachers were evaluated with regards to subject area differences. With regards to differences among subject areas, science teachers the most likely to integrate computers as a research tool (Barron et al., 2003). In a 1998 study conducted by the Center for Research and Information Technology Organizations, technology integration within subject areas was examined (Barron et al.). Results of this study concluded that students in self-contained elementary school classes or in technology-related courses in high school were more likely to use technology. According to Forster (2006), technology applications that assist in the transformation or translation of information entered by the user have shown to assist mathematics curriculum. For data analysis, respondent were divided into two groups: those who taught in fields generally thought of as using higher levels of technology skills (Science, Mathematics, and Technology Education) and those who taught in fields generally thought of as using fewer levels of technology skills (Humanities, Elementary Education, PE, and other electives). The two newly constructed variables were dichotomous and were directly entered into the regression model.

The third independent variable used in this study was grade level teaching assignment. The five categories that were used in the demographic section of the LoTiQ survey for this research study: elementary school, middle school, high school, multiple grade levels, and all grade levels (K-12) are were based on grade level teaching assignments identified by Learning Quest (2006). In a research study of technology in K-12 schools of one of the nation’s largest school districts, comparisons were made across grade levels. When teachers’ integration of computers in the classrooms was compared across grade levels, elementary school teachers were more likely to use computers as a problem-solving or communication tool than middle or high school teachers (Barron et al., 2003). McCannon and Crews (2000) found that elementary technology professional development courses were catered towards administrative tasks such as word processing rather than curriculum integration, presentation software, and research. Bebell et al. (2004) reported that elementary teachers use technology more frequently to accentuate lessons and asked students to use technology more often in the classroom than middle and high school teachers. Middle and high school teachers reported using technology more frequently for grading purposes than elementary teachers. For data analysis, respondent were divided into two groups: Elementary and Secondary. The two newly constructed variables were dichotomous and were directly entered into the regression model.

The fourth independent variable used in this study was age. Each participant gave his or her age based on his or her last birthday. Research has revealed a relationship between age and negative attitudes towards computers (DeOllos & Morris, 2003; Morris, 1989). In research conducted by DeOllos and Morris and Hardy (1998), a direct link was found between age and computer attitudes that indicated as age increased so did negative attitudes toward computers. According to Loyd and Gressard (1984), developmental and socialization characteristics of various age groups appeared to play a role in openness to computer-related instruction.

The fifth independent variable used in this study was gender. Participants chose either male or female. Gender is often included as a demographic variable is research studies (Alreck & Settle, 1995; Creswell, 1994). Several non-empirical observations have claimed that females were more likely to exhibit computer anxiety. Hargittai and Shafer (2006) conducted a study regarding differences in actual and perceived online skills with regards to gender. Results from that study indicated a significant difference with regards to gender and self-perceived skill levels. Women were more likely to lack confidence in themselves when it came to self-perception of their online skills (Correll 2001; Craig 1999; Hargittai & Shafer). For data analysis, respondent were divided into two groups: Male and Female. The two newly constructed variables were dichotomous and were directly entered into the regression model.

Table 1 lists the independent variables used in the study along with the coding measurements for each.

Table 1

Independent Variable Coding Summary for Regression Analysis

Variable	Measurement
Method of completing the technology requirement for recertification	1 – ITT = 1 2 – Non-ITT = 0
Certification Field	1 – Technology Related = 1 2 – Non-Technology Related = 0
Grade Level Teaching Assignment	1 – Elementary School = 1 2 – Secondary = 0
Age	Actual Age based on last birthday
Gender	1 – Female = 1 2 – Male = 0

Data Analysis

In this research study, there were four dependent variables, Current Instructional Practice (CIP), Personal Computer Use (PCU), Level of Technology Implementation (LoTi) and Level of Technology Implementation total score. Separate stepwise multiple regression analyses were used for this study to determine which variables could be combined to provide the best predictors on each dependent variable. "Multiple regression is used determine the correlation between a criterion variable and a combination of two or more predictor variables" (Gall et al., 2003, p. 340). Multiple regression is one of the most widely used statistical techniques in educational research and is the technique of choice when research questions pertain to prediction (Huberty & Petoskey, 1999). Multiple regression is versatile in that is can handle categorical and continuous variables providing estimates of the magnitude and statistical significance of relationships between variables. Based on a review of the literature, an alpha level (α) of .05 was used to assess the effect of the independent variables on the dependent variable (Gall et al.; Huck, 2004;

Keppel, 1991). Frequency counts were computed for all independent variables and for the dependent variable. *The Statistical Package for Social Sciences* (SPSS) 15.0 for Windows was used for the statistical analysis.

Effect Size

Effect size is an estimate of the magnitude of the difference, relationship, or effect between groups being studied (Gall et al., 2003). Effect size estimates may be categorized into two broad categories: correlation ratios and standardized differences (Rojewski, 2001). Correlation ratios, such as Pearson's *r* correlation, are computed by dividing the sum of squares for an effect by the total sum of squares. Pearson's *r* can range from -1.00 to 1.00. A -1.00 indicates a perfect negative relationship, a 1.00 indicates a perfect positive relationship, and zero indicates no relationship between two variables (Moore, 2000). Standardized differences, such as Cohen's d, are calculated by subtracting the mean of group two from the mean of group one. The difference is then divided by the estimated standard deviation (Coe, 2000). Based on a literature review of previous research using the LoTi Questionnaire, Pearson's *r* correlation which identifies small, medium, and large effect sizes as r = .1, .3, and .5 respectively, were used in this study to calculate for all significant findings (Criscione, 2005; Gliner, Vaske, & Morgan, 2001; Learning Quest, 2006; Valentine & Cooper, 2003).

CHAPTER 4

RESULTS

The purpose of this correlational study was to analyze the characteristics of educators in a large public school district in the state of Georgia to provide predictors of Personal Computer Use (PCU), Current Instructional Practices (CIP), Level of Technology Implementation, and Level of Technology Implementation (LoTi) total score as measured by the Level of Technology Implementation Questionnaire (LoTiQ). Results of this study may contribute to the development of future technology professional development programs.

This chapter presents the results of the analyses conducted to address each of the research questions. Analyses include descriptive statistics and regression analysis. Four separate multiple regression analyses were used to determine which independent variables could be combined to provide the best predictors on each of the dependent variables: PCU, CIP, LoTi, and LoTi total score. The independent variables were method of completing the technology requirement for recertification, certification field, grade level teaching assignment, age, and gender. Based on a review of the literature, an alpha level (α) of .05 was used to assess the effect of the independent variables on each of the dependent variables (Gall et al., 2003; Huck, 2004; Keppel, 1991). Data was analyzed using the *Statistical Package for the Social Sciences* (SPSS) version 15.0 for Windows. Frequency counts were computed for all independent variables and dependent variables. Descriptive statistics were computed that included: minimum, maximum, mean, and standard deviation as show on Table 2. Descriptive statistics note the variability among demographics regarding educators who responded in full to the survey packet.

Table 2

Descriptive Statistics

	Minimum	Maximum	Mean	Std. Deviation
Method[a]	0	1	0.54	0.499
Certification Field[b]	0	1	0.12	0.32
Grade level[c]	0	1	0.55	0.498
Age[d]	23	67	42.28	11.382
Gender[e]	0	1	0.86	0.347

Note. [a]Method: 0 = Non-ITT, 1 = ITT; [b]Certification Field: 0 = Non-technology related, 1 = Technology related; [c]Grade level: 0 = Secondary, 1 = Elementary; [d]Age: Based on last birthday; [e]Gender: 0 = Male, 1 = Female; N = 365.

With regards to the independent variable method of completing the technology requirement for recertification, this study included 198 (54.2%) ITT participants and 167 (45.8%) non-ITT participants. The independent variable certification field included 42 (11.5%) technology related fields and 323 (88.5%) non-technology related fields. The independent variable grade level contained 202 (55.3%) elementary school educators and 163 (44.7%) secondary educators. The frequency counts for the independent variable age were provided in Appendix P. The independent variable gender included 314 (86.0%) female and 51 (14%) male.

Due to the sample groups for the independent variables certification field and gender not being close in numbers, independent t-tests were used to determine if the means of technology related fields versus non-technology related fields and females versus males were statistically significant with regards to each of the dependent variables. No significance was found. Therefore, results received from the regression analysis pertaining to those two independent variables appeared to be accurate.

Statistical Summaries and Data Analysis

Research Question One

What combination of method of completing the technology requirement for certification, certification field, grade level teaching assignment, age, and gender provided the best model for predicting educators' Personal Computer Use (PCU) scores?

The following figure and tables provide frequency counts for the dependent variable PCU based on all independent variables first grouped together and then broken out individually.

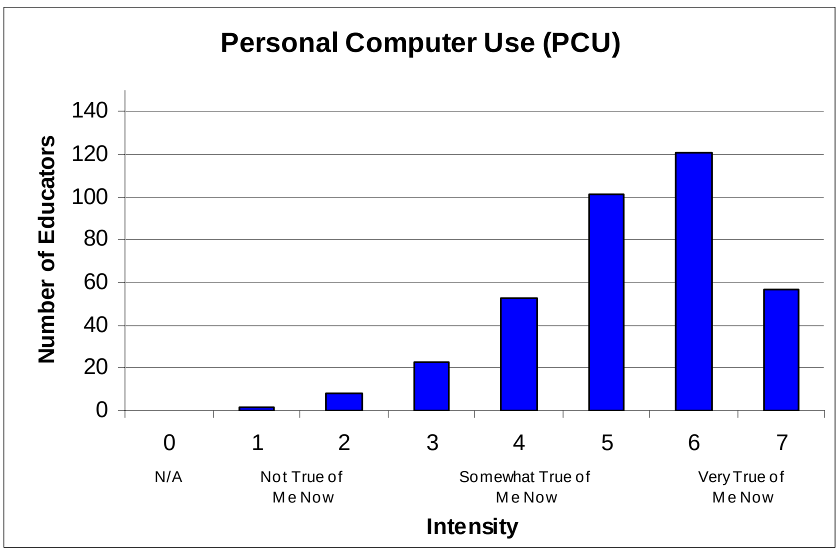

Figure1. Personal Computer Use (PCU) ranking based on 365 respondents.

The PCU profile addresses an educator's comfort and proficiency level with using computers. This includes troubleshooting simple hardware problems and using multimedia applications (Learning Quest, 2003). The level with the highest percentage was intensity level 6.

The first independent variable was method of completing the technology requirement for recertification. Participants chose (a) test out portfolio, (b) ITT course, (c) AssessOnline test, (d)

Other, and (e) None (I have not completed the technology requirement for recertification. Options 1 through 3 were choices specific to educators in this large public school system to meet the technology requirement for recertification through HB1187 (GCPS, 2001; 2006b; Georgia Legislature, 2000). For data analysis, respondents were divided into two groups: ITT participants and non-ITT participants. There were 198 ITT participants (54.2%) in this study. One hundred and sixty-seven participants were Non-ITT (45.8%). Table 3 provides frequency counts for method of completion based on the dependent variable PCU.

Table 3

Frequency Table for Method - PCU

PCU	ITT	%	Non-ITT	%
0	0	0.0%	0	0.0%
1	1	0.5%	1	0.6%
2	6	3.0%	2	1.2%
3	15	7.6%	8	4.8%
4	32	16.2%	21	12.6%
5	69	34.8%	34	20.4%
6	58	29.3%	63	37.7%
7	17	8.6%	38	22.7%
Total	198	100%	167	100%

Based on this information, the change in percentages between ITT and Non-ITT participants varied the most at level intensity level 7. According to the Personal Computer Use (PCU) Framework, participants at this level were expert computer users, troubleshooters, and/or technology mentors (Learning Quest, 2006). According to the data, 55 individuals (15.1%) scored in level 6. Of those 55 individuals, 38 (69.1%) were Non-ITT participants.

The second independent variable was certification field. This study was specific to a large public school system in Georgia. Certification Field was divided into two groups: technology related fields (Science, Mathematics, and Technology Education) and non-technology related fields (Humanities, Elementary Education, PE, and other electives). There were 42 technology related field participants (11.5%) in this study. Three hundred and twenty three participants (88.5%) were non-technology related fields. Table 4 provides frequency counts for certification field.

Table 4

Frequency Table for Certification Field - PCU

PCU	Technology Related	%	Non-Technology Related	%
0	0	0.0%	0	0.0%
1	0	0.0%	2	0.6%
2	1	2.4%	7	2.2%
3	2	4.8%	21	6.5%
4	4	9.5%	49	15.2%
5	11	26.2%	92	28.5%
6	16	38.1%	105	32.5%
7	8	19.0%	47	14.5%
Total	42	100%	323	100%

Based on this information, the change in percentages between technology related and non-technology related participants varied the most at intensity level 4. Based on the PCU

Framework, educators at this level used a broader range of software applications and had the confidence to troubleshoot simple hardware or software concerns without assistance (Learning Quest, 2006). According to the data, 53 individuals (14.5%) scored in level 4a. Of those 53 individuals, 49 (92.5%) were non-technology related teachers.

The third independent variable was grade level teaching assignment. The five categories that were used in the demographic section of the LoTiQ survey for this research study: elementary school, middle school, high school, multiple grade levels, and all grade levels (K-12) were based on grade level teaching assignments identified by Learning Quest (2006). For data analysis, participants were grouped into two groups: elementary and secondary. There were 202 elementary participants (55.3%) in this study. One hundred and sixty three participants (44.7%) were secondary. Table 5 provides frequency counts for grade level. Based on this information, the change in percentages between Elementary and Secondary participants varied the most at Intensity Level 6. Based on the PCU Framework, educators at this level were sophisticated in the use of most applications and typically served as troubleshooters for others (Learning Quest, 2006). According to the data, 121 individuals (33.2%) scored in level 5. Of those 121 individuals, 66 (54.5%) were elementary teachers.

Table 5

Frequency Table for Grade Level - PCU

PCU	Elementary	%	Secondary	%
0	0	0.0%	0	0.0%
1	1	0.5%	1	0.6%
2	5	2.5%	3	1.8%
3	15	7.4%	8	4.9%
4	33	16.3%	20	12.3%
5	65	32.2%	38	23.3%
6	55	27.2%	66	40.5%
7	28	13.9%	27	16.6%
Total	202	100%	163	100%

The fourth independent variable was age. Each participant gave his or her age based on his or her last birthday. Age was entered into the regression analysis as a continuous variable. Frequency counts for age are provided in Appendix P. For reporting purposes, participants were grouped into two groups: early adulthood (25-45 years) and middle adulthood (46-65 years) based on Buhler's theory of development (Okun, 1984) which very nearly corresponded to the age range of the participants in this study which was 23 to 67. There were 211 early adulthood participants (57.8%) in this study. One hundred and fifty four participants (42.2%) were secondary. Table 6 provides frequency counts for age.

Table 6

Frequency Table for Age - PCU

PCU	Early Adulthood	%	Middle Adulthood	%
0	0	0.0%	0	0.0%
1	2	0.9%	0	0.0%
2	3	1.5%	5	3.2%
3	10	4.7%	14	9.1%
4	30	14.2%	23	14.9%
5	56	26.5%	47	30.5%
6	76	36.0%	45	29.2%
7	34	16.2%	20	13.1%
Total	211	100%	154	100%

Based on this information, the change in percentages between early and middle adulthood participants varied the most at intensity level 6. Based on the PCU Framework, educators at this level were sophisticated in the use of most applications and typically served as troubleshooters for others (Learning Quest, 2006). According to the data, 121 individuals (33.2%) scored in Intensity Level 6. Of those 121 individuals, 76 (62.8%) were early adulthood participants.

The fifth independent variable was gender. Participants chose either male or female. There were fifty-one male participants (14.0%) in this study. Three hundred and fourteen participants (86.0%) were female. Table 7 provides frequency counts for gender.

Table 7

Frequency Table for Gender - PCU

PCU	Female	%	Male	%
0	0	0.0%	0	0.0%
1	2	0.6%	0	0.0%
2	7	2.2%	1	2.0%
3	19	6.1%	4	7.8%
4	43	13.7%	10	19.6%
5	94	29.9%	9	17.6%
6	105	33.4%	16	31.4%
7	44	14.1%	11	21.6%
Total	314	100%	51	100%

Based on this information, the change in percentages between Male and Female participants varied the most at intensity level 5. Based on the PCU Framework, educators at this level were commonly able to use the computer to create their own web pages and effortlessly used common productivity applications. They were also able to competently troubleshoot most hardware and software concerns (Learning Quest, 2006). According to the data, 103 individuals (28.2%) scored in level 4b. Of those 103 individuals, 94 (91.3%) were Female participants.

Using stepwise multiple regression analysis for the dependent variable, PCU, method of completing the technology requirement, grade level, and age proved to be statistically significant at the .05 level. The final model to emerge form the stepwise regression model contained three predictor variables: method, grade, and age. Adjusted $R^2 = .047$; $F_{3,361} = 7.046$, $p < .001$. Significant variables are shown in Table 8.

Table 8

Significant Variables Resulting from Stepwise Regression - PCU

Variable	Beta	*p*
Method	-.136	.014
Grade	-.115	.025
Age	-.112	.041

As a follow-up procedure, linear regression was calculated using the five independent variables and the dependent variable PCU. That analysis confirmed the significance for the variables method of completing the technology requirement for recertification and age as seen in Table 9.

Table 9

Standardized Regression Coefficients for Independent Variables - PCU

Variable	Standardized coefficients	t	Sig
Method	-.137	-2.488	.013
Field	.034	.616	.538
Grade	-.109	-1.897	.059
Age	-.112	-2.038	.042
Gender	.020	.367	.714

A correlation coefficient matrix was considered for further analysis to determine if any relationships were present between the independent variables and the dependent variable. The correlation coefficient matrix did show significant relationships between the independent variables and dependent variable as shown in Table 10 with regards to method of completing technology requirement for recertification, grade level, and age.

Table 10

Correlation Matrix – PCU

		Method	Field	Grade	Age	Gender	PCU
Method	Pearson Correlation	1					
	Sig. (2-tailed)						
Field	Pearson Correlation	.021	1				
	Sig. (2-tailed)	.690					
Grade	Pearson Correlation	.027	-.367**	1			
	Sig. (2-tailed)	.610	.000				
Age	Pearson Correlation	.353**	-.029	-.015	1		
	Sig. (2-tailed)	.000	.585	.771			
Gender	Pearson Correlation	.011	-.226**	.337**	.075	1	
	Sig. (2-tailed)	.841	.000	.000	.150		
PCU	Pearson Correlation	-.200**	.062	-.117	-.163**	-.016	1
	Sig. (2-tailed)	.000	.236	.025	.002	.766	

**Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Research Question Two

What combination of method of completing the technology requirement for certification, certification field, grade level teaching assignment, age, and gender provided the best model for predicting educators' Current Instructional Practices (CIP) scores?

The following figure and tables provide frequency counts for the dependent variable CIP based on all independent variables first grouped together and then broken out individually.

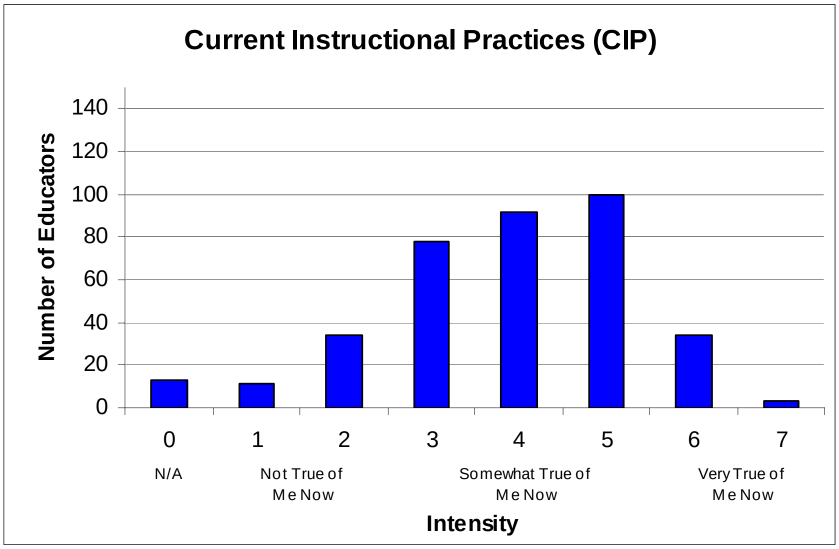

Figure 2. Current Instructional Practices based on 365 respondents

The CIP profile reveals the educator's inclination toward instructional practices consistent with a learner-based curriculum design. Learning materials are determined based on the problem areas identified. Multiple assessment strategies are integrated throughout the curriculum and teachers act as a co-learner/facilitator focusing on learner-based questions (Learning Quest, 2003). The level with the highest intensity was level 5.

The first independent variable was method of completing the technology requirement for recertification. Participants were grouped into two groups: ITT participants and Non-ITT participants. There were 198 ITT participants (54.2%) in this study. One hundred and sixty-seven participants were Non-ITT (45.8%). Table 11 provides frequency counts for method of completion based on the dependent variable CIP.

Table 11

Frequency Table for Method - CIP

CIP	ITT	%	Non-ITT	%
0	6	3.0%	7	4.2%
1	6	3.0%	5	3.0%
2	19	9.6%	16	9.6%
3	39	19.7%	39	23.4%
4	53	26.8%	38	22.8%
5	57	28.8%	44	26.3%
6	17	8.6%	16	9.6%
7	1	0.5%	2	1.1%
Total	198	100%	167	100%

Based on this information, the change in percentages between ITT and Non-ITT participants varied the most at intensity level 4. Based on the Current Instructional Practices (CIP) Framework, participants at this level felt comfortable supporting or implementing either a subject-matter or learning-based approach to instruction based on the content addressed (Learning Quest, 2006). According to the data, 91 individuals (24.9%) scored in level 4a. Of those 91 individuals, 53 (58.2%) were ITT participants.

The second independent variable was certification field. This study was specific to a large public school system in Georgia. Certification Field was divided into two groups: technology related fields (Science, Mathematics, Technology Education) and non-technology related fields (Humanities, Elementary Education, PE, and other electives). There were 42 technology related field participants (11.5%) in this study. Three hundred and twenty-three

participants (88.5%) were non-technology related fields. Table 12 provides frequency counts for certification field.

Table 12

Frequency Table for Certification Field - CIP

CIP	Technology Related	%	Non-Technology Related	%
0	0	0.0%	13	4.0%
1	1	2.4%	10	3.2%
2	3	7.1%	32	9.9%
3	12	28.6%	66	20.4%
4	12	28.6%	79	24.5%
5	11	26.2%	90	27.9%
6	3	7.1%	30	9.2%
7	0	0.0%	3	0.9%
Total	42	100%	323	100%

Based on this information, the change in percentages between technology related and non-technology related participants varied the most at intensity level 3. Based on the CIP Framework, the educator supported instructional practices aligned somewhat with a subject-matter based approach to teaching and learning with sequential and uniform learning activities for all students (Learning Quest, 2006). According to the data, 78 individuals (21.4%) scored in level 3. Of those 78 individuals, 66 (84.6%) were Non-Technology Related teachers.

The third independent variable was grade level teaching assignment. The five categories that were used in the demographic section of the LoTiQ survey for this research study: elementary school, middle school, high school, multiple grade levels, and all grade levels (K-12) were based on grade level teaching assignments identified by Learning Quest (2006). For data analysis, participants were grouped into two groups: elementary and secondary. There were 202 elementary participants (55.3%) in this study. One hundred and sixty three participants (44.7%) were secondary. Table 13 provides frequency counts for grade level.

Table 13

Frequency Table for Grade Level - CIP

CIP	Elementary	%	Secondary	%
0	7	3.5%	6	3.7%
1	4	2.0%	7	4.3%
2	29	14.4%	6	3.7%
3	45	22.3%	33	20.2%
4	45	22.3%	46	28.2%
5	57	28.2%	44	27.0%
6	15	7.3%	18	11.0%
7	0	0.0%	3	1.9%
Total	202	100%	163	100%

Based on this information, the change in percentages between elementary and secondary participants varied the most at intensity level 2. Based on the CIP Framework, learning activities tended to be sequential and uniform for all students. Evaluation measures focused on traditional forms such as essays, quizzes, short-answers, and/or true-false questions. Student projects tended to be teacher-directed with regards to outcomes and requirements for completion (Learning Quest, 2006). According to the data, 35 individuals (9.6%) scored in level 2. Of those 35 individuals, 29 (82.9%) were elementary teachers.

The fourth independent variable was age. Each participant gave his or her age based on his or her last birthday. Age was entered into the regression analysis as a continuous variable. Frequency counts for age are provided in Appendix P. For reporting purposes, participants were grouped into two groups: early adulthood (25-45 years) and middle adulthood (46-65 years) based on Buhler's theory of development (Okun, 1984). There were 211 early adulthood participants (57.8%) in this study. One hundred and fifty four participants (42.2%) were secondary. Table 14 provides frequency counts for age.

Table 14

Frequency Table for Age - CIP

CIP	Early Adulthood	%	Middle Adulthood	%
0	5	2.4%	8	5.2%
1	6	2.8%	5	3.2%
2	16	7.6%	19	12.3%
3	49	23.2%	29	18.8%
4	56	26.5%	35	22.7%
5	60	28.4%	41	26.6%
6	17	8.1%	16	10.4%
7	2	1.0%	1	0.8%
Total	211	100%	154	100%

Based on this information, the change in percentages between early and middle adulthood participants varied the most at intensity level 2. Based on the CIP Framework, learning activities tended to be sequential and uniform for all students. Evaluation measures focused on traditional forms such as essays, quizzes, short-answers, and/or true-false questions. Student projects tended to the teacher-directed with regards to outcomes and requirements for completion (Learning Quest, 2006). According to the data, 35 individuals (9.6%) scored in Intensity Level 2. Of those 35 individuals, 19 (54.3%) were early adulthood participants.

The fifth independent variable was gender. Participants chose either male or female. There were fifty-one male participants (14.0%) in this study. Three hundred and fourteen participants (86.0%) were female. Table 15 provides frequency counts for gender.

Table 15

Frequency Table for Gender - CIP

CIP	Female	%	Male	%
0	11	3.5%	2	3.9%
1	9	2.9%	2	3.9%
2	32	10.2%	3	5.9%
3	65	20.7%	13	25.5%
4	73	23.2%	18	35.3%
5	92	29.3%	9	17.6%
6	29	9.2%	4	7.9%
7	3	1.0%	0	0.0%
Total	314	100%	51	100%

Based on this information, the change in percentages between Male and Female participants varied the most at intensity level 4. Based on the CIP Framework, educators felt comfortable supporting or implementing either a subject-matter or learning-based approach to instruction based on the content being addressed (Learning Quest, 2006). According to the data, 91 individuals (24.9%) scored in level 4a. Of those 91 individuals, 73 (80.2%) were Female participants.

With regards to the dependent variable CIP, none of the independent variables proved to be statistically significant with stepwise regression analysis. As a follow-up procedure, linear regression analysis was used. The linear regression analysis provided one model as shown in Table 16. Standardized regression coefficients are listed in Table 17.

Table 16

R^2 and adjusted R^2 using all independent variables - CIP

N	R^2	Adj. R^2	Std Error
365	.018	.005	1.4511

Table 17

Standardized Regression Coefficients for Independent Variables - CIP

Variable	Standardized coefficients	t	Sig
Method	.050	.891	.373
Field	-.016	-.279	.780
Grade	-.107	-1.814	.071
Age	-.090	-1.606	.109
Gender	.090	1.611	.108

Based on the statistical analysis, .5% of the variance in the total LoTi score was explained by the independent variables. Based on the regression model, there were no variables that proved to be significant

A correlation coefficient matrix was considered for further analysis to determine if any relationships were present between the independent variables and the dependent variable. The correlation coefficient matrix did not show any significant relationships between the independent variables and dependent variable as shown in Table 18.

Table 18

Correlation Matrix – CIP

		Method	Field	Grade	Age	Gender	CIP
Method	Pearson Correlation	1					
	Sig. (2-tailed)						
Field	Pearson Correlation	.021	1				
	Sig. (2-tailed)	.690					
Grade	Pearson Correlation	.027	-.367**	1			
	Sig. (2-tailed)	.610	.000				
Age	Pearson Correlation	.353**	-.029	-.015	1		
	Sig. (2-tailed)	.000	.585	.771			
Gender	Pearson Correlation	.011	-.226**	.337**	.075	1	
	Sig. (2-tailed)	.841	.000	.000	.150		
CIP	Pearson Correlation	.020	.019	-.091	-.056	.046	1
	Sig. (2-tailed)	.704	.719	.082	.285	.383	

**Correlation is significant at the 0.01 level (2-tailed)

Research Question Three

What combination of method of completing the technology requirement for certification, certification field, grade level teaching assignment, age, and gender provided the best model for predicting educators' Level of Technology Implementation (LoTi) scores?

The following figure and tables provide frequency counts for the dependent variable LoTi based on all independent variables first grouped together and then broken out individually.

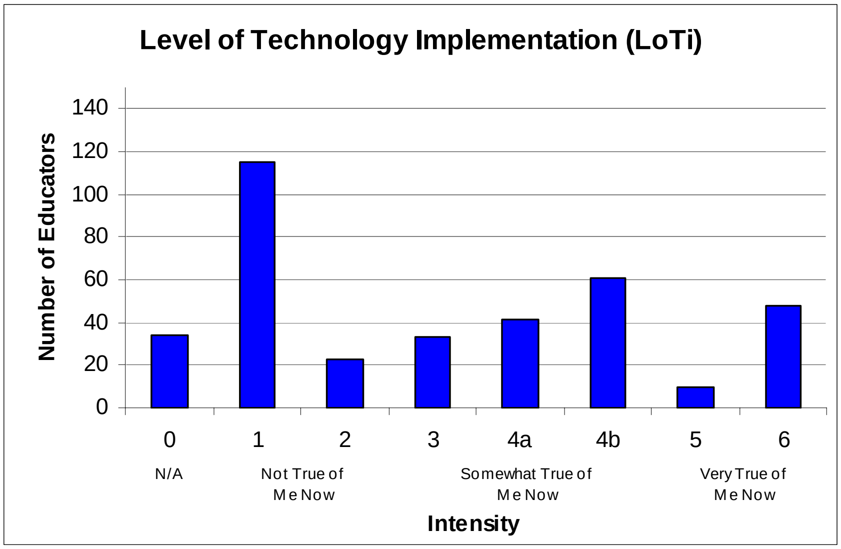

Figure 3. Level of Technology Implementation based on 365 respondents

The LoTi profile approximates the degree each educator is implementing or supporting the implementation of computers into the curriculum (Learning Quest, 2003). The score with the highest percentage was level 1, Awareness.

The first independent variable was method of completing the technology requirement for recertification. Participants were grouped into two groups: ITT participants and Non-ITT participants. There were 198 ITT participants (54.2%) in this study. One hundred and sixty-seven participants were Non-ITT (45.8%). Table 19 provides frequency counts for method of completion based on the dependent variable PCU.

Table 19

Frequency Table for Method- LoTi

LoTi	ITT	%	Non-ITT	%
0	20	10.1%	14	8.4%
1	62	31.3%	53	31.7%
2	10	5.1%	13	7.8%
3	17	8.6%	16	9.6%
4a	27	13.6%	14	8.4%
4b	29	14.6%	32	19.2%
5	6	3.0%	4	2.4%
6	27	13.4%	21	12.5%
Total	198	100%	167	100%

Based on this information, the change in percentages between ITT and non-ITT participants varied the most at level 4a, Integration (Mechanical). At this level, the focus was on student actions and resolutions to issues using higher levels of cognitive processing and in-depth examination of the content (Learning Quest, 2003). According to the data, 41 individuals (11.2%) scored in level 4a. Of those 41 individuals, 27 (65.9%) were ITT participants.

The second independent variable was certification field. This study was specific to a large public school system in Georgia. Certification Field was divided into two groups: technology related fields (Science, Mathematics, Technology Education) and non-technology related fields (Humanities, Elementary Education, PE, and other electives). There were 42 technology related field participants (11.5%) in this study. Three hundred and twenty three

participants (88.5%) were non-technology related fields. Table 20 provides frequency counts for certification field.

Table 20

Frequency Table for Certification Field - LoTi

LoTi	Technology Related	%	Non-Technology Related	%
0	1	2.4%	33	10.2%
1	14	33.3%	101	31.3%
2	2	4.7%	21	6.5%
3	8	19.0%	25	7.7%
4a	3	7.1%	38	11.8%
4b	5	11.9%	56	17.3%
5	0	0.0%	10	3.1%
6	9	21.6%	39	12.1%
Total	42	100%	323	100%

Based on this information, the change in percentages between technology related and non-technology related participants varied the most at level 3, Infusion. Based on the Level of Technology Implementation Framework, this level relied heavily on technology based tools to complement instructional events (Learning Quest, 2003). According to the data, 33 individuals (9.0%) scored in level 3. Of those 33 individuals, 25 (75.8%) were non-technology related teachers.

The third independent variable was grade level teaching assignment. The five categories that were used in the demographic section of the LoTiQ survey for this research study: elementary school, middle school, high school, multiple grade levels, and all grade levels (K-12) were based on grade level teaching assignments identified by Learning Quest (2006). For data analysis, participants were grouped into two groups: elementary and secondary. There were 202 elementary participants (55.3%) in this study. One hundred and sixty three participants (44.7%) were secondary. Table 21 provides frequency counts for grade level.

Table 21

Frequency Table for Grade Level - LoTi

LoTi	Elementary	%	Secondary	%
0	19	9.4%	15	9.2%
1	73	36.1%	42	25.8%
2	12	5.9%	11	6.7%
3	13	6.4%	20	12.3%
4a	27	13.4%	14	8.6%
4b	33	16.3%	28	17.2%
5	5	2.6%	5	3.1%
6	20	9.9%	28	17.1%
Total	202	100%	163	100%

Based on this information, the change in percentages between elementary and secondary participants varied the most at level 1, Awareness. Based on the Level of Technology Implementation Framework, this level used technology-based tools for classroom management tasks, to enhance a teacher directed lesson, and/or in a lab setting removed from the classroom teacher (Learning Quest, 2003). According to the data, 115 individuals (31.5%) scored in level 1. Of those 115 individuals, 73 (63.5%) were elementary teachers.

The fourth independent variable was age. Each participant gave his or her age based on his or her last birthday. Age was entered into the regression analysis as a continuous variable. Frequency counts for age are provided in Appendix P. For reporting purposes, participants were grouped into two groups: early adulthood (25-45 years) and middle adulthood (46-65 years) based on Buhler's theory of development (Okun, 1984). There were 211 early adulthood participants (57.8%) in this study. One hundred and fifty four participants (42.2%) were secondary. Table 22 provides frequency counts for age.

Table 22

Frequency Table for Age - LoTi

LoTi	Early Adulthood	%	Middle Adulthood	%
0	21	10.0%	13	8.4%
1	59	28.0%	56	36.4%
2	12	5.7%	11	7.1%
3	21	10.0%	12	7.8%
4a	26	12.3%	15	9.7%
4b	37	17.5%	24	15.6%
5	5	2.4%	5	3.2%
6	30	14.1%	18	11.8%
Total	211	100%	154	100%

Based on this information, the change in percentages between early and middle adulthood participants varied the most at level 1, Awareness. Based on the Level of Technology Implementation Framework, this level used technology-based tools for classroom management tasks, to enhance a teacher directed lesson, and/or in a lab setting removed from the classroom teacher (Learning Quest, 2003). According to the data, 115 individuals (31.5%) scored in level 1. Of those 115 individuals, 59 (51.3%) were early adulthood participants.

The fifth independent variable was gender. Participants chose either male or female. There were fifty-one male participants (14.0%) in this study. Three hundred and fourteen participants (86.0%) were female. Table 23 provides frequency counts for gender.

Table 23

Frequency Table for Gender - LoTi

LoTi	Female	%	Male	%
0	29	9.2%	5	9.8%
1	102	32.5%	13	25.5%
2	20	6.4%	3	5.9%
3	29	9.2%	4	7.8%
4a	35	11.1%	6	11.8%
4b	53	16.9%	8	15.7%
5	7	2.2%	3	5.9%
6	39	12.5%	9	17.6%
Total	314	100%	51	100%

Based on this information, the change in percentages between Male and Female participants varied the most at level 1, Awareness. Based on the Level of Technology Implementation Framework, this level used technology-based tools for classroom management tasks, to enhance a teacher directed lesson, and/or in a lab setting removed from the classroom teacher (Learning Quest, 2003). According to the data, 115 individuals (31.5%) scored in level 1. Of those 115 individuals, 102 (88.7%) were Female participants.

Using stepwise multiple regression analysis for the dependent variable LoTi, grade level proved to be statistically significant at the .05 level. The final model to emerge form the stepwise regression model contained the one variable grade. Adjusted $R^2 = .008$; $F_{1,363} = 4.009$, $p < ..046$. The significant variable is shown in Table 24.

Table 24

Significant Variable Resulting from Stepwise Regression - LoTi

Variable	Beta	*p*
Grade	-.105	.046

As a follow-up procedure, linear regression was calculated using the five independent variables and the dependent variable LoTi. That analysis did not confirm the significance for the variable grade level as shown in Table 25.

Table 25

Standardized Regression Coefficients for Independent Variables - LoTi

Variable	Standardized coefficients	t	Sig
Method	.011	.193	.847
Field	.005	..089	.929
Grade	-.093	-1.575	.116
Age	-.018	-.322	.748
Gender	.373	-.549	.583

A correlation coefficient matrix was considered for further analysis to determine if any relationships were present between the independent variables and the dependent variable. The correlation coefficient matrix did show a significant relationship between the independent variables and dependent variable as shown in Table 26 with regards to grade level.

Table 26

Correlation Matrix – LoTi

		Method	Field	Grade	Age	Gender	LoTi
Method	Pearson Correlation	1					
	Sig. (2-tailed)						
Field	Pearson Correlation	.021	1				
	Sig. (2-tailed)	.690					
Grade	Pearson Correlation	.027	-.367**	1			
	Sig. (2-tailed)	.610	.000				
Age	Pearson Correlation	.353**	-.029	-.015	1		
	Sig. (2-tailed)	.000	.585	.771			
Gender	Pearson Correlation	.011	-.226**	.337**	.075	1	
	Sig. (2-tailed)	.841	.000	.000	.150		
LoTi	Pearson Correlation	.002	.047	-.105*	-.015	-.065	1
	Sig. (2-tailed)	.974	.372	.046	.770	.218	

**Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

<u>Research Question Four</u>

What combination of method of completing the technology requirement for certification, certification field, grade level teaching assignment, age, and gender provided the best model for predicting educators' Level of Technology Implementation (LoTi) total scores?

The following figure and tables provide frequency counts for the dependent variable LoTi total score based on all independent variables first grouped together and then broken out individually.

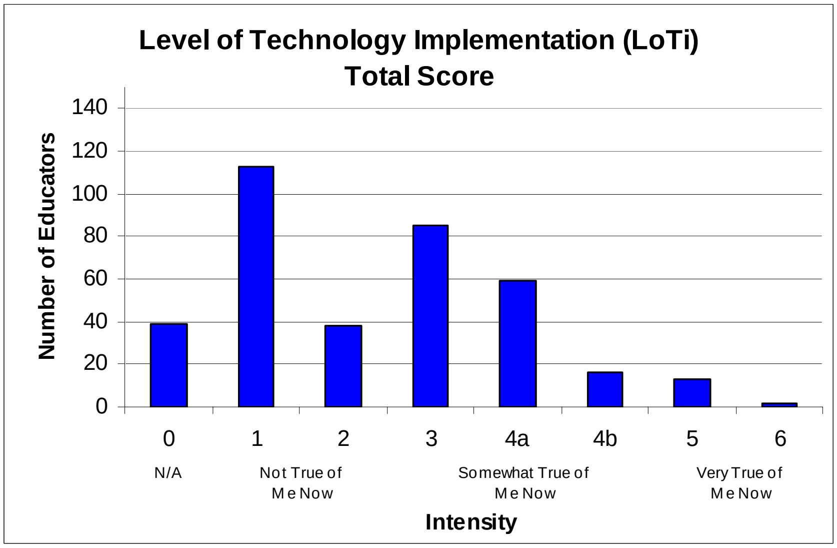

Figure 4. Level of Technology Implementation total score based on 365 respondents with the highest percentage being level 1, Awareness.

The first independent variable was method of completing the technology requirement for recertification. Participants were grouped into two groups: ITT participants and Non-ITT participants. There were 198 ITT participants (54.2%) in this study. One hundred and sixty-seven participants were non-ITT (45.8%). Table 27 provides frequency counts for method of completion.

Table 27

Frequency Table for Method – LoTi Total Score

LoTi Total Score	ITT	%	Non-ITT	%
0	21	10.6%	18	10.8%
1	62	31.3%	51	30.5%
2	20	10.1%	18	10.8%
3	45	22.7%	40	23.9%
4a	32	16.2%	27	16.2%
4b	8	4.0%	8	4.8%
5	10	5.1%	3	1.8%
6	0	0%	2	1.2%
Total	198	100%	167	100%

Based on this information, the change in percentages between ITT and Non-ITT participants varied the most at level 5, Expansion. At this level technology was extended beyond the classroom to include technology applications and networking from outside sources to expand experiences geared towards problem solving, issue resolution, and student activism. According to the data, 13 individuals (3.6%) scored in level 5. Of those 13 individuals, 10 (77%) were ITT participants.

The second independent variable was certification field. This study was specific to a large public school system in Georgia. Certification Field was divided into two groups: technology related fields (Science, Mathematics, Technology Education) and non-technology related fields (Humanities, Elementary Education, PE, and other electives). There were 42 technology related field participants (11.5%) in this study. Three hundred and twenty three

participants (88.5%) were non-technology related fields. Table 28 provides frequency counts for certification field.

Table 28

Frequency Table for Certification Field – LoTi Total Score

LoTi Total Score	Technology Related	%	Non-Technology Related	%
0	2	4.8%	37	11.5%
1	14	33.3%	99	30.7%
2	3	7.1%	35	10.8%
3	10	23.8%	75	23.2%
4a	10	23.8%	49	15.2%
4b	1	2.4%	15	4.6%
5	2	4.8%	11	3.4%
6	0	0%	2	0.6%
Total	42	100%	323	100%

Based on this information, the change in percentages between technology related and non-technology related participants varied the most at level 4a, Integration (Mechanical). Based on the Level of Technology Implementation Framework, this level relied heavily on prepackaged materials. Emphasis was placed on student action and/or on issues resolution that required higher levels of cognitive processing and in-depth examination of the content (Learning Quest, 2003). According to the data, 59 individuals (16.2%) scored in level 4a. Of those 59 individuals, 49 (83%) were non-technology related teachers.

The third independent variable was grade level teaching assignment. The five categories that were used in the demographic section of the LoTiQ survey for this research study:

elementary school, middle school, high school, multiple grade levels, and all grade levels (K-12) were based on grade level teaching assignments identified by Learning Quest (2006). For data analysis, participants were grouped into two groups: elementary and secondary. There were 202 elementary participants (55.3%) in this study. One hundred and sixty three participants (44.7%) were secondary. Table 29 provides frequency counts for grade level.

Table 29

Frequency Table for Grade Level – LoTi Total Score

LoTi Total Score	Elementary	%	Secondary	%
0	18	8.9%	21	12.9%
1	71	35.1%	42	25.8%
2	24	11.9%	14	8.6%
3	48	23.8%	37	22.7%
4a	29	14.4%	30	18.4%
4b	7	3.5%	9	5.5%
5	4	1.9%	9	5.5%
6	1	0.5%	1	0.6%
Total	202	100%	163	100%

Based on this information, the change in percentages between elementary and secondary participants varied the most at level 1, Awareness. According to the data, 113 individuals (31%) scored in level 1. Of those 113 individuals, 71 (62.8%) were elementary teachers. Also, beginning at level 4a through level 6, secondary teachers had a higher percentage of teachers in each level compared to elementary teachers.

The fourth independent variable was age. Each participant gave his or her age based on his or her last birthday. Age was entered into the regression analysis as a continuous variable. Frequency counts for age are provided in Appendix P. For reporting purposes, participants were grouped into two groups: early adulthood (25-45 years) and middle adulthood (46-65 years) based on Buhler's theory of development (Okun, 1984). There were 211 early adulthood participants (57.8%) in this study. One hundred and fifty four participants (42.2%) were secondary. Table 30 provides frequency counts for age.

Table 30

Frequency Table for Age – LoTi Total Score

LoTi Total Score	Early Adulthood	%	Middle Adulthood	%
0	22	10.4%	17	11.0%
1	58	27.5%	55	35.7%
2	19	9.0%	19	12.3%
3	56	26.5%	29	18.8%
4a	40	19.0%	19	12.3%
4b	6	2.8%	10	6.5%
5	9	4.3%	4	2.7%
6	1	0.5%	1	0.7%
Total	211	100%	154	100%

Based on this information, the change in percentages between early and middle adulthood participants varied the most at Level 1, Awareness. Based on the Level of Technology Implementation Framework, this level used technology-based tools for classroom management tasks, to enhance a teacher directed lesson, and/or in a lab setting removed from the classroom teacher (Learning Quest, 2003). According to the data, 113 individuals (31%) scored in Level 1. Of those 113 individuals, 58 (51.3%) were early adulthood participants.

The fifth independent variable was gender. Participants chose either male or female. There were fifty-one male participants (14.0%) in this study. Three hundred and fourteen participants (86.0%) were female. Table 31 provides frequency counts for gender.

Table 31

Frequency Table for Gender – LoTi Total Score

LoTi Total Score	Female	%	Male	%
0	33	10.5%	6	11.8%
1	100	31.8%	13	25.4%
2	34	10.8%	4	7.8%
3	71	22.6%	14	27.5%
4a	47	15.0%	12	23.5%
4b	15	4.8%	1	2.0%
5	12	3.8%	1	2.0%
6	2	0.7%	0	0.0%
Total	314	100%	51	100%

Based on this information, the change in percentages between Male and Female participants varied the most at level 4a, Integration (Mechanical). According to the data, 59 individuals (16.2%) scored in level 4a. Of those 59 individuals, 47 (79.7%) were Female participants.

With regards to the dependent variable LoTi total score, none of the independent variables proved to be statistically significant with stepwise regression analysis. As a follow-up procedure, linear regression analysis was used. The linear regression analysis provided one model as shown in Table 32.

Table 32

R^2 and adjusted R^2 using all independent variables – LoTi Total Score

N	R^2	Adj. R^2	Std Error
365	.011	-.003	1.619

Based on the statistical analysis, .3% of the variance in the total LoTi score was explained by the independent variables. Based on the regression model, there were no variables that proved to be significant as shown in Table 33.

Table 33

Standardized Regression Coefficients for Independent Variables – LoTi Total Score

Variable	Standardized coefficients	t	Sig
Method	.028	.493	.622
Field	.017	.294	.769
Grade	-.094	-1.594	.112
Age	-.046	-.815	.416
Gender	.024	.430	.668

The correlation coefficient matrix was considered for further analysis to determine if any relationships were present between the independent variables and the dependent variable. The correlation coefficient matrix did not show any significant relationships between the independent variables and dependent variable as shown in Table 34.

Table 34

Correlation Matrix – LoTi Total Score

		Method	Field	Grade	Age	Gender	LoTiQ
Method	Pearson Correlation	1					
	Sig. (2-tailed)						
Field	Pearson Correlation	.021	1				
	Sig. (2-tailed)	.690					
Grade	Pearson Correlation	.027	-.367**	1			
	Sig. (2-tailed)	.610	.000				
Age	Pearson Correlation	.353**	-.029	-.015	1		
	Sig. (2-tailed)	.000	.585	.771			
Gender	Pearson Correlation	.011	-.226**	.337**	.075	1	
	Sig. (2-tailed)	.841	.000	.000	.150		
LoTiQ	Pearson Correlation	.010	.048	-.091	-.033	-.014	1
	Sig. (2-tailed)	.855	.364	.084	.525	.783	

**Correlation is significant at the 0.01 level (2-tailed)

Summary of Results

The independent variables included in this study were method of completing the technology requirement for recertification, certification field, grade level teaching assignment, age, and gender. Stepwise multiple regression confirmed that method of competing the technology requirement for certification, grade level and age were statistical significant for the dependent variable PCU. Follow-up analysis using linear regression indicated significance with method of completing technology requirement for recertification and age. Follow-up analysis using a correlation matrix also determined that there were significant relationships between the independent variables method of completing the technology requirement for recertification, grade level, and age and the dependent variable PCU.

With regards to the dependent variable CIP, stepwise multiple regression determined that none of the independent variable were statistical significant with regards to the dependent variable. Follow-up analysis using linear regression indicated no significance. Additional analysis using a correlation matrix also confirmed that there were no significant relationships between the independent variables method of completing the technology requirement for recertification, grade level, age, and gender and the dependent variable CIP.

Stepwise multiple regression determined grade level to be statistical significant for the dependent variable LoTi. Follow-up analysis using linear regression indicated no statistical significance. However, additional follow-up analysis using a correlation matrix confirmed the stepwise multiple regression output that there was a significant relationship between the independent variable grade level and the dependent variable LoTi.

With regards to the dependent variable LoTi total score, stepwise multiple regression determined that none of the independent variables were statistical significant on the dependent variable. Follow-up analysis using linear regression indicated no significance. Additional analysis using a correlation matrix also confirmed that there were no significant relationships between the independent variables method of completing the technology requirement for recertification, grade level, age, and gender and the dependent variable LoTi total score.

Information was derived from examining frequency tables comparing percentages of educators who scored at each level. Based on the data regarding method of completing the technology requirement for recertification and the dependent variable PCU, 279 (76.4%) of the educators scored at intensity levels 5-7. Of those 279 educators, 144 (51.6%) were ITT participants and 135 (48.4%) were non-ITT participants. When evaluating the data regarding the independent variable grade level based on the dependent variable PCU, 279 (76.4%) of the educators scored at intensity levels 5-7. Of those 279 educators, 148 (53.0%) taught in an elementary school and 131 (47%) taught in a secondary school. Based on the data regarding age, 278 educators scored at Intensity Levels 5-7. Of those 278 educators, 166 (60%) were early adulthood and 112 (40%) were middle adulthood. When evaluating the data regarding the independent variable grade level based on the dependent variable LoTi, 119 (32.6%) of the educators scored at levels 4b – 6. Of those 119 educators, 58 (48.7%) taught in an elementary school and 61 (51.3%) taught in a secondary school.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter restates the rational, purpose, and objectives of this study. A brief summary of the study method and results of the analyses then follows. Conclusions drawn from the analyses and the implications of the findings are discussed. Finally, recommendations for technology-professional development and future research are discussed.

Rationale

There is a high price tag for effectively incorporating technology into classroom instruction. Educational technology research is needed to help justify how and why those funds are well spent. This research is especially important to extinguish criticisms of the inconsistent impact and low usage of technology by educators regardless of type of training and access to resources (Roblyer & Knezek, 2003).

Teacher education and professional development programs should be catered around standards for student learning and for excellence in teaching practice (Darling-Hammond, 1997; Hamsa, 1998; Wise, 1996). One strategy for creating a greater cohesiveness between theory and practice is the creation of programs that develop technological skills that support student and teacher learning in the information age (Darling-Hammond). Findings from this study will provide technology-professional development leaders further insight on the impact of technology-professional development programs on educators across all grade levels. Findings from this research study could be used by professional development leaders and school and county administrators to develop technology training programs that are the most beneficial to instruction.

School systems are investing significant money to increase the availability of computers and other forms of technology for student and teacher use. Teachers must have the confidence to know when and how to use technology within instruction (Burke, 1998; Hardy, 1998; Office of Technology Assessment, 1995). Teacher education and professional development programs should be catered around standards for student learning and for excellence in teaching practice (Hamsa, 1998; Wise, 1996).

Reacting to this need for increased technology standards for teachers, a large public school system in Georgia established three options for their educators to meet the technology requirement for recertification which included a test-out portfolio, ITT, and AssessOnline (GCPS, 2001, 2006b). To assist educators in making the decision of which program to choose, a website was created at http://www.gwinnett.k12.ga.us/gtat/ providing an overview and general information on the three options and any necessary forms (GCPS, 2001, 2006b).

Building upon the Concerns Based Adoption Model and the Level of Technology Implementation Framework, the Level of Technology Implementation (LoTi) Questionnaire (LoTiQ) was created to assess classroom practices tied to higher order thinking skills (Moersch, 1997). The LoTi questionnaire assists decision-makers in determining how school building level stakeholders (teachers, administrators, technology specialists) are either implementing or supporting the use of technology associated with influential teaching or learning opportunities directed at student achievement (Learning Quest, 2003).

The results of this study have the potential to guide the creation of future technology-professional development programs. Consideration should be made regarding factors such as method of completing the technology requirement for recertification, certification field, grade level, age, and gender when developing technology professional development programs.

Previous research has show differences regarding technology ease of use levels across factors such as: method of completing a technology requirement (Criscione, 2005; Sheumaker, Minor, Fowler, Price, & Zahner, 2001), certification field (as identified in other literature as subject area) (Barron et al.; Becker; Hanks), grade level (Barron, Kemker, Harmes, & Kalaydjian, 2003; Becker, 2001; Bebell, Russell, & O'Dwyer, 2004; Hanks, 2002; McCannon & Crews, 2000), age (Baack & Brown, 1991; Czaja et al., 2006; DeOllos & Morris, 2003; Morris, 1989), and gender (Broos, 2005; Correll, 2001; Craig, 1999; Hargittai & Shafer, 2006; van Braak, Tondeur, & Valcke, 2004).

The purpose of this correlational study was to analyze the characteristics of educators in a large public school district in the state of Georgia to provide predictors of Personal Computer Use (PCU), Current Instructional Practices (CIP), Level of Technology Implementation, and Level of Technology Implementation (LoTi) total score as measured by the Level of Technology Implementation Questionnaire (LoTiQ). Results of this study may contribute to the development of future technology professional development programs. The specific questions addressed in this study were:

Research Question One

What combination of method of completing the technology requirement for certification, certification field, grade level teaching assignment, age, and gender provided the best model for predicting educators' Personal Computer Use (PCU) scores?

Research Question Two

What combination of method of completing the technology requirement for certification, certification field, grade level teaching assignment, age, and gender provided the best model for predicting educators' Current Instructional Practices (CIP) scores?

Research Question Three

What combination of method of completing the technology requirement for certification, certification field, grade level teaching assignment, age, and gender provided the best model for predicting educators' Level of Technology Implementation (LoTi) scores?

Research Question Four

What combination of method of completing the technology requirement for certification, certification field, grade level teaching assignment, age, and gender provided the best model for predicting educators' Level of Technology Implementation (LoTi) scores?

Method

Design

A correlational research design was used for this study. The purpose of correlational studies is to discover relationships between variables (Gall et al., 2003). The researcher cannot determine causality from the results. The quality of correlational studies is determined by the depth of the rational and the theoretical framework that guides the design. Correlational studies are best used to measure the degree and direction of relationships. Advantages of using a correlational study include: (a) researchers are allowed to analyze relationships among a large number of variables in a single study and (b) information is provided concerning the degree of the relationships between the variables being studied (Gall et al.).

Population and Sample

The population for this study was certified teachers in a large public school district in the state of Georgia employed during the 2006-2007 school year as identified by this school system's employment records. This population included elementary, middle, and high school teachers in all subject areas. No generalizations were made beyond this large public school system in Georgia. The population for this study consisted of 11,932 certified teachers.

Instrumentation

The assessment instrument used for measuring the dependent variables in this research study was the LoTi Questionnaire. According to Moersch (1999, ¶ 4), the LoTiQ was designed to generate a profile across three domains detailing the level of an educator's implementation: Levels of Technology Implementation (LoTi); personal computer use (PCU), which evaluates the individual educator's comfort and proficiency level using software application programs and troubleshooting simple hardware problems; and current instructional practices (CIP), which identifies an educator's preference for instructional practices that are consistent with a learner-based curriculum design. Based on an educator's LoTi, PCU, and CIP, specific follow-up interventions may be developed to meet each individual educator's current technology needs (Moersch). A portion of the questionnaire included demographic questions. These questions were included at the end of the LoTi Questionnaire. According to Hill (2001), it was important to include these types of questions at the end of the survey. Questions placed at the beginning of a survey instrument might have distracted a participant's attention from the survey items that require careful consideration.

Procedure

Permission to conduct this study was obtained from the University of Georgia Institutional Review Board (UGA IRB) (Appendix I) along with the Board of Education for the major public school system in Georgia (Appendix J) being studied prior to implementation. To insure confidentiality, all participants were assigned an identification number. Names of participants were not included on questionnaires and data was reported in aggregate only. To facilitate follow-up procedures, a master list of identifiers which linked the participant's name to the number on the questionnaire was maintained during the collection period. The master list was destroyed at the conclusion of the data collection. This study was conducted as a mail survey. Dillman's (1978) recommended survey procedures and timing were used to maximize the return rate.

Data Analysis

Data analysis was completed using the Statistical Package for the Social Sciences (SPSS) version 15.0. The analysis began with descriptive measures. Separate regression analyses were used for this study to determine which variables could be combined to provide the best predictors on each dependent variable using an alpha of .05. Of the five independent variables (method of completing the technology requirement, certification field, grade level, age, and gender), all but age were treated as dichotomous categorical variables. The independent variable age and all of the dependent variables (PCU, CIP, LoTi, and LoTi total score) were treated as continuous variables and analyzed using regression analysis.

Summary of Findings

Of the 365 participants in this study, 198 (54.2%) were ITT participants. The educators average age was 42.28 and 314 (86.0%) of the participants were female. Two hundred and two (55.3%) of the educators taught at the elementary level and 323 (88.5%) taught in a Non-Technology related field.

There were no significant differences in the Personal Computer Use (PCU), Current Instructional Practices (CIP), Level of Technology Implementation (LoTi), and Level of Technology Implementation total score based upon certification field or gender. The variables that did have a significant impact were method of the completing the technology requirement for recertification, grade level, and age.

Based on the results of the analyses regarding the dependent variable PCU, the variables, method, grade, and age all had a negative correlation. Non-ITT participants were coded 0 and ITT participants were coded 1. The PCU scores were higher for individuals who did not participate in ITT. Secondary teachers were also coded 0 and elementary teachers were coded 1. The PCU scores were higher for individuals who were secondary teachers. Finally, age was entered into the regression analysis as a continuous variable. As age increased, PCU decreased. Based on Pearson's *r* correlation, all relationships represented small effect sized.

Based on the results of the analyses regarding the dependent variable LoTi, the variable, grade had a negative correlation. Secondary teachers were coded 0 and elementary teachers were coded 1. The LoTi scores were higher for individuals who were secondary teachers. Based on Pearson's *r* correlation, the relationship represented small effect size.

Conclusions

Based on the analyses conducted, there were significant differences found between the method of completing the technology requirement for recertification, grade level, and age with regards to the dependent variable PCU. Based on the dependent variable LoTi, there was a significant difference found with regards to the independent variable grade level. These findings agreed with prior research conducted in these areas. Previous research studies have determined that participation in a technology-professional development program impacted an educator's level of technology implementation. Sheumaker et al. conducted a study regarding Georgia's InTech program, a constructivist-based technology training program used to meet the technology requirement for recertification. Results of their study indicated that teachers who received technology training in an InTech classroom had higher perceived levels of technology integration than individuals who participated in an InTech redelivery method at the local schools or individuals who received no InTech training. Criscione (2005) conducted a study using the LoTiQ to assess technology integration levels of teachers based on participation versus non-participation in Title III Technology Literacy Challenge Fund courses. Results indicated that participation in the Title III Technology Literacy Challenge Fund courses did have an impact on technology implementation in the classroom (Technology Literacy Challenge, 1996).

Results from this study indicated that the dependent variables CIP, LoTi and LoTi total score were not significant with regards to the independent variable method of completing the technology requirement for recertification. However, significance was found between the independent variable method of completing the technology requirement for recertification and the dependent variable PCU. Based on the negative correlation, it appeared that individuals who already possessed high levels of PCU did not take the ITT course. These individuals appeared to have enough confidence in their own computer use and troubleshooting abilities that they chose one of the other options for completing the technology requirement for recertification such as the test-out portfolio or AssessOnline.

Previous studies comparing teachers' integration of computers in classrooms across grade levels and subject areas concluded that elementary school teachers were more likely to use computers as a problem-solving or communication tool than middle or high school teachers (Barron et al., 2003; Hanks, 2002). McCannon and Crews (2000) found that elementary technology professional development courses were catered towards administrative tasks such as word processing rather than curriculum integration, presentation software, and research. Bebell et al. (2004) reported that elementary teachers used technology more frequently to accentuate lessons and ask students to use technology more often in the classroom than middle and high school teachers. Middle and high school teachers reported using technology more frequently for grading purposes than elementary teachers (Bebell et al.).

Results from this study indicated that the dependent variables CIP and LoTi total score were not significant with regards to the independent variable grade level. However, significance was found between the independent variable grade level and the dependent variables PCU and LoTi. Based on the negative correlations, it appeared that individuals who already possessed high levels of PCU were secondary teachers. Results of this study appeared to be similar to previous research in that elementary teachers possessed a lower LoTi score that secondary teachers. Technology for elementary teachers was teacher-centered focusing on isolated tasks.

Research has also revealed a connection between age and negative attitudes towards computers (DeOllos & Morris, 2003; Morris, 1989). In a study conducted by Czaja et al. (2006), results indicated that older adults were using technology at an increasing rate. However, older adults had more difficulty than younger adults when learning to use and operate current technologies such as computers and the Internet. Baack and Brown (1991) concluded that the benefits for acquiring new technology skills must be communicated to older adults. Otherwise, older adult users would have little motivation to learn.

Results from this study indicated that the dependent variables CIP, LoTi and LoTi total score were not significant with regards to the independent variable age. However, significance was found between the independent variable age and the dependent variable PCU. Based on the negative correlation, it appeared that as the ages of the participants increased the PCU scores decreased. These results were similar to previous research regarding older adults having more difficulty that younger adults learning to use and operate current technologies.

A large scale research study was conducted nationwide during the 2002-2003 school year using the LoTiQ (Learning Quest, 2003). A total of 32,560 educators completed the survey. Findings from the study concluded that 9% of the nation's educators self-assessed themselves at the Target Technology Level as defined by the National Education Technology Standards (NETS) and Technology Standards for School Administrators (TSSA). The Target Technology Level was met when technology in incorporated into challenging, engaging learning experiences that promote problem-solving, critical thinking, and self-directed learning (Learning Quest). Sixty-seven percent of respondents ranked themselves in Nonuse through Exploration, the lower portion of the LoTi Framework. Although 99% of respondents indicated having access to instructional computers for teachers and students, only 67% of educators felt comfortable using computers at home and in the workplace (Learning Quest).

Based on the results of this study, it appeared that 172 participants (47%) ranked themselves in Nonuse through Exploration, the lower portion of the LoTi Framework. All participants indicated having access to instructional computers for teachers and students. The results of this study indicated that only ten participants ranked themselves in the intensity levels 0 – 2 with regards to PCU. Therefore, 355 (97%) indicated that they felt comfortable using computers at home and the workplace.

The intensity level for PCU that had the highest percentage of educators was level 6. The intensity level for CIP that had the highest percentage of educators was level 5. The LoTi level that had the highest percentage of educators was level 1, awareness. The LoTi total score that had the highest percentage of educators was level 1, awareness. These results indicated that educators were doing very well with their own personal computer use, troubleshooting, and identification of instructional practices that reflected a learner-based curriculum design. The concern was the lack of technology implementation.

Discussion and Implications

To address the levels of significance found in this study with regards to method of completing the technology requirement for recertification, technology-professional development leaders should consider offering technology-professional development programs in a variety of advanced topics and also at varying ability levels. Based on the results of this study, 22.7% of the individuals who did not participate in ITT scored at intensity level 7 compared to only 8.6% of the individuals who participated in ITT. Participants at intensity level 7 were expert computer users, troubleshooters, and/or technology mentors who were typically involved in training others on any technology-related task (Learning Quest, 2006). Based on the results, it appeared that participants who already possessed confidence in their own personal computer use did not choose ITT as the means for completing the technology requirement for recertification. ITT participants scored the highest percentage at intensity level 5. Based on the PCU framework, these participants were comfortable with their own personal computer use and were capable of solving most hardware and software problems.

To address the levels of significance found in this study with regards to grade level, technology-professional development leaders should consider offering technology-professional development programs in a variety of advanced topics and also at varying ability levels. Based on the results of this study, 57.1% of the individuals were secondary teachers who scored at intensity levels 6 - 7 compared to only 41.1% of the elementary teachers. Participants at Intensity Levels 6 - 7 were expert computer users, troubleshooters, and/or technology mentors who were typically involved in training others on any technology-related task (Learning Quest, 2006).

To address the levels of significance found in this study with regards to age, technology-professional development leaders should consider offering technology-professional development programs in a variety of more advanced topics and also at varying ability levels. Based on the results of this study, 52.2% of the early adulthood participants scored at intensity levels 6 - 7 compared to only 42.3% of the middle adulthood participants. Participants at intensity level 6 - 7 were expert computer users, troubleshooters, and/or technology mentors who were typically involved in training others on any technology-related task (Learning Quest, 2006). Based on the results, it appeared that participants who already possessed confidence in their own personal computer use were in the early adulthood age grouping. Middle adulthood participants score the highest at intensity level 5. Based on the framework, these participants were comfortable with their own personal computer use and were capable of solving most hardware and software problems.

To address the levels of significance found in this study with regards to age and the dependent variable Level of Technology Implementation, technology-professional development leaders should consider offering technology-professional development programs in a variety of topics. Based on the results of this study with regards to the negative correlation between grade level and LoTi, secondary educators appeared to be extending technology beyond the classroom. They were basing the complexity of the technology based tools on the inventiveness and spontaneity of the teacher's experiential based approach and the students' level of complex thinking skills and using technology less as an embellishment on teacher-directed lessons and extension activities (Learning Quest, 2006). With regards to elementary school teachers, it appeared that the LoTi scores decreased compared to secondary teachers. Technology-professional development courses to consider for this grade level included methods for seamlessly incorporating technology into the curriculum for students to use with problem solving and/or product development activities focusing on real-world problems or issues significant to them. According to the data, elementary teachers were doing very well using technology to assist with administrative tasks and extension activities. By offering more advanced technology-professional development training, elementary teachers would obtain the skills necessary to progress to a higher implementation level.

Recommendations

The following recommendations for further research are made based upon the findings and conclusion of this study.

1. A longitudinal study that uses a pre/post test to compare an educator's skill level prior to taking a technology professional development course to skills levels at the course completion could provide further information regarding whether or not that specific course impacted technology implementation. Knowing if a technology professional development course was a predictor of technology implementation would be beneficial to professional development leaders in addition to school and county administrators to develop technology training programs that are the most beneficial to instruction.
2. The use of a mixed methods approach combining quantitative with qualitative data could also provide further information into reasons why an educator scored at the level indicated on the LoTi questionnaire. Quantitative measures would identify and classify using statistical data levels of technology implementation. Qualitative measures would

be useful to explore deeper through interviews why or why not an educator possess the skills as indicated on the survey instrument.

3. The survey instrument used is another area that could be addressed in further research studies. The LoTi questionnaire addresses current instructional practice, personal computer use, and level of technology implementation. A teacher could possess high levels of technology skills. However, the way the questions are worded on the survey instrument, skills possessed in not being evaluated. The LoTi questionnaire measures skills that are currently being used. Therefore, another instrument could be considered either to replace the LoTi in further research on be given in combination with the LoTi comparing technology skills possessed versus skills used.
4. Data from this study was specific to certified teachers from this large public school district in Georgia and cannot be generalized to other groups. The use of a broader sample that could be generalized to other groups should be considered.

The following recommendations for practice and future technology-professional development programs are made based upon the findings and conclusion of this study.

1. Provide technology-professional development for lower-level LoTi teachers that models specific strategies and techniques for integrating higher-order thinking skills using software that is readily available to teachers and students.
2. Provide technology-professional development for lower-level LoTi teachers that models techniques for using only one computer in a classroom.
3. Provide technology-professional development that allows higher-level LoTi teachers the opportunity to design and model technology integration units for others.

4. Provide technology-professional development for lower-level PCU teachers that increases confidence in using and troubleshooting personal computers.
5. Provide technology-professional development that moves a greater percentage of educators from a teacher-based to a learner-based curriculum design.

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APPENDIX A

TECHNOLOGY INTEGRATION ON-THE-JOB ASSESSMENT INSTRUMENT

Technology Integration
On-the-Job Assessment Instrument: *Certified Teacher*

To be completed by a principal, assistant principal, or department chair in consultation with the local school technology coordinator, if needed.

Evaluatee: ___________________________ Position: _________________________
Evaluator: _________________________________ Position: _________________________
Evaluatee's Social Security Number: __________________ Date of Observation: ________________
Lesson activity observed: ____

To receive a passing score on the assessment, participants must have no more than 5 items checked in the "Does Not Meet Standards" column.

Criteria	*Meets Standards*	*Does Not Meet Standards*
I. Technology Operations and Concepts	❑ Demonstrates competency using basic software, hardware and computer terminology.	❑ Minimal use of basic software, hardware and computer terminology.
	❑ Evidence of participation in or teaching of learning opportunities that heighten awareness of current and emerging technologies.	❑ No evidence of participation in or teaching of technology learning opportunities.
II. Planning and Designing Learning Environments and Experiences	❑ Plans appropriate learning opportunities that apply GCPS technology competencies and the AKS.	❑ Does not plan appropriate learning opportunities that apply GCPS technology competencies and the AKS.
	❑ Demonstrates use of technology as a tool to heighten student awareness of thinking processes.	❑ Minimal use of technology as a tool to heighten student awareness of thinking processes.
	❑ Matches appropriate technology resources to AKS learning objectives.	❑ Does not match appropriate technology resources to AKS learning objectives.
	❑ Plans for all students to have access to school technologies as an integral lesson activity.	❑ Does not plan for students to have access to school technologies as an integral lesson activity.
	❑ Designs and implements rotation strategies to ensure all students have equal access to technologies.	❑ Does not design and implement rotation strategies to ensure all students have equal access to technologies.
III. Teaching, Learning, and the Curriculum	❑ Uses technology to accommodate student learning styles, individual, and academic needs.	❑ Does not use technology to accommodate student learning styles, individual, and academic needs.
	❑ Presents technology-enhanced lessons that lead students to analyze, synthesize, and evaluate relevant problems.	❑ Does not present technology-enhanced lessons that lead students to analyze, synthesize, and evaluate relevant problems.

	❑ Arranges and manages physical space and student movement to enhance the use of technologies.	❑ Physical space and student movement is not arranged and managed to enhance the use of technologies.
IV. Assessment and Evaluation	❑ Applies technology in assessing student learning of the AKS.	❑ Technology is not used as a means of assessing student learning of the AKS.
V. Productivity and Professional Practice	❑ Evidence of the use of technology resources for personal and professional development in the past two years.	❑ No evidence of the use of technology resources for personal and professional development.
	❑ Evidence of evaluation on use of technology to support student learning through RBES or GTAM.	❑ No evidence of evaluation on use of technology to support student learning through RBES or GTAM.
	❑ Demonstrates use of technologies to increase personal and professional productivity.	❑ Technology is not used to increase personal and professional productivity.
	❑ Uses technology to communicate with students, parents, administrators, and peers.	❑ Does not communicate with students, parents, administrators, and peers using technology.
VI. Social, Ethical, Legal, and Human Issues	❑ Models and teaches legal and ethical practice related to technology use.	❑ Does not model and teach legal and ethical practice related to technology use.
	❑ Establishes classroom policies and procedures that promote safe use of technology resources.	❑ No classroom policies and procedures evident that promote safe use of technology resources.

Comments:____

____

Candidate's Signature: ______________________________ Date: _________________________

Evaluator's Signature: _____________________________ Date: _________________________

GTAT Class Participants: **Class participants and evaluators should keep a copy for their records. Class participants must give one copy to their GTAT Instructor before the final class.**
Test-out Candidates: **Test-out candidates and evaluators should keep a copy for their records. A copy should also be sent with their completed portfolio to the Director of Media and Information Services.**

Signature acknowledges receipt of the form by the candidate, not necessarily concurrence. Written comments may be provided and/or attached. Initial and date here if comments are attached.
____

APPENEDIX B

THE LEVELS OF TECHNOLOGY IMPLEMENTATION (LOTI) FRAMEWORK

The Levels of Technology Implementation (LoTi) Framework

Nonuse

Technology-based tools (e.g., computers) are either (a) completely unavailable in the classroom, (b) not easily accessible by the classroom teacher, or (c) there is a lack of time to pursue electronic technology implementation. Existing technology is predominantly text-based (e.g., ditto sheets, chalkboard, overhead projector).

Awareness

The use of technology-based tools is either (a) used almost exclusively by the classroom teacher for classroom and/or curriculum management tasks (e.g., taking attendance, using grade book programs, accessing email), (b) used to embellish or enhance teacher-directed lessons or lectures (e.g., multimedia presentations) and/or (c) is one step removed from the classroom teacher (e.g., integrated learning system labs, special computer lab pull-out programs, central word processing labs).

Exploration

Technology-based tools supplement the existing instructional program (e.g., tutorials, educational games, basic skill applications) or complement selected multimedia and/or web-based projects (e.g., internet-based research papers, informational multimedia presentations) at the knowledge/comprehension level. The electronic technology is employed either as extension activities, enrichment activities, or technology-based tools and generally reinforces the content under investigation.

Infusion

Technology-based tools including spreadsheet and graphing packages; multimedia and desktop publishing applications; and the internet complement selected instructional events or multimedia/web-based projects at the analysis, synthesis, and evaluation levels. Though the learning activity may or may not be perceived as authentic by students, emphasis is placed on using a variety of thinking skill strategies (e.g., problem-solving, decision-making, experimentation, scientific inquiry) to address the content under investigation.

Integration (Mechanical)

Technology-based tools are integrated in a mechanical manner that places heavy reliance on prepackaged materials, outside resources, and/or interventions that aid the teacher in the daily management of their operational curriculum. Technology is perceived as a toll to identify and solve authentic problems as perceived by the students relating to an overall theme/concept. Emphasis is placed on student action and/or on issues resolution that requires higher level of cognitive processing and in-depth examination of the content.

Integration (Routine)

Technology-based tools are integrated in a routine manner whereby teachers can readily design and implement learning experiences (e.g., units of instruction) that empower students to identify and solve authentic problems relating to an overall theme/concept using the school’s available technology with little or no outside assistance. Emphasis is placed on student action and/or issues resolution that requires higher levels of student cognitive processing and in-depth examination of the content.

Expansion
Technology access is extended beyond the classroom. Teachers actively elicit technology applications and networking from outside sources to expand student experiences directed at problem-solving, issues resolution, and student activism. The complexity and sophistication of the technology-based tools used are now commensurate with (a) the diversity, inventiveness, and spontaneity of the teacher's experiential-based approach and (b) the students' level of complex thinking and in-depth understanding of the content at hand.

Refinement
Technology is perceived as a process, product, and/or tool for students to find solutions related to an identified "real-world" problem or issue of significance to them. Technology provides a seamless medium for information queries, problem-solving, and/or product development. The classroom content emerges based on the needs of the learner according to his/her interests, needs, and/or aspirations and is supported by unlimited access to the most current computer applications and infrastructure available.

(Learning Quest, 2003)

APPENEDIX C

THE PERSONAL COMPUTER USE (PCU) FRAMEWORK

The Personal Computer Use (PCU) Framework

Intensity Level 0
A PCU Intensity Level 0 indicates that the participant does not feel comfortable or have the skill level to use computers for personal use. Participants at Intensity Level 0 rely more on the use of overhead projectors, chalkboards, and/or traditional paper/pencil activities than using computers for conveying information or classroom management tasks.

Intensity Level 1
A PCU Intensity Level 1 indicates that the participant demonstrates little skill level with using computers for personal use. Participants at Intensity Level 1 may have a general awareness of various technology-related tools such as word processors, spreadsheets, or the internet, but generally are not using them.

Intensity Level 2
A PCU Intensity Level 2 indicates that the participant demonstrates little to moderate skill level with using computers for personal use. Participants at Intensity Level 2 may occasionally browse the internet, use email, or use a word processor program; yet, may not have the confidence or feel comfortable troubleshooting simple "technology" problems or glitches as they arise. At school, their use of computers may be limited to a grade book or attendance program.

Intensity Level 3
A PCU Intensity Level 3 indicates that the participant demonstrates moderate skill level with using computers for personal use. Participants at Intensity Level 3 may begin to become "regular" users of selected applications such as the internet, email, or a word processor program. They may also feel comfortable troubleshooting simple "technology" problems such as rebooting a machine or hitting the "Back" button on an internet browser, but rely on mostly technology support staff or others to assist them with any troubleshooting issues.

Intensity Level 4
A PCU Intensity Level 4 indicates that the participant demonstrates moderate to high skill level with using computers for personal use. Participants at Intensity Level 4 commonly use a broader range of software applications including multimedia (e.g., Microsoft PowerPoint, HyperStudio), spreadsheets, and simple database applications. They typically have the confidence and are able to troubleshoot simple hardware, software, and/or peripheral problems without assistance from technology support staff.

Intensity Level 5
A PCU Intensity Level 5 indicates that the participant demonstrates high skill level with using computers for personal use. Participants at Intensity Level 5 are commonly able to use the computer to create their own web pages, produce sophisticated multimedia products, and/or effortlessly use common productivity applications (e.g., Microsoft Excel, FileMaker Pro), desktop publishing software, and web-based tools. They are also able to confidently troubleshoot most hardware, software, and/or peripheral problems without assistance from technology support staff.

Intensity Level 6

A PCU Intensity Level 6 indicates that the participant demonstrates high to extremely high skill level with using computers for personal use. Participants at Intensity Level 6 are sophisticated in the use of most, if not all, multimedia, productivity, desktop publishing, and web-based applications. They typically serve as "troubleshooters" for others in need of assistance and sometimes seek certification for achieving selected technology-related skills.

Intensity Level 7

A PCU Intensity Level 7 indicates that the participant demonstrates extremely high skill level with using computers for personal use. Participants at Intensity Level 7 are expert computer users, troubleshooters, and/or technology mentors. They typically are involved in training others on any technology-related task and are usually involved in selected support groups from around the world that allow them access to answers for all technology-based inquiries they may have.

(Learning Quest, 2006)

APPENEDIX D

THE CURRENT INSTRUCTIONAL PRACTICES (CIP) FRAMEWORK

The Current Instructional Practices (CIP) Framework

Intensity Level 0
A CIP Intensity Level 0 indicates that one or more questionnaire statements were not applicable to the participant's current instructional practices.

Intensity Level 1
At a CIP Intensity Level 1, the participant's current instructional practices align exclusively with a subject-matter based approach to teaching and learning. Teaching strategies tend to lean toward lectures and/or teacher-led presentations. The use of curriculum materials aligned to specific content standards serves as the focus for student learning. Learning activities tend to be sequential and uniform for all students. Evaluation techniques focus on traditional measures such as essays, quizzes, short-answers, or true-false questions. Student projects tend to be teacher-directed in terms of identifying project outcomes as well as requirements for project completion.

Intensity Level 2
Similar to a CIP Intensity Level 1, the participant at a CIP Intensity Level 2 supports instructional practices consistent with a subject-matter based approach to teaching and learning, but not at the same level of intensity or commitment. Teaching strategies tend to lean toward lectures and/or teacher-led presentations. The use of curriculum materials aligned to specific content standards serves as the focus for student learning. Learning activities tend to be sequential and uniform for all students. Evaluation techniques focus on traditional measures such as essays, quizzes, short-answers, or true-false questions. Student projects tend to be teacher-directed in terms of identifying project outcomes as well as requirements for project completion.

Intensity Level 3
At a CIP Intensity Level 3, the participant supports instructional practices aligned somewhat with a subject-matter based approach to teaching and learning‹an approach characterized by sequential and uniform learning activities for all students, teacher-directed presentations, and/or the use of traditional evaluation techniques. However, the participant may also support the use of student-directed projects that provide opportunities for students to determine the "look and feel" of a final product based on specific content standards.

Intensity Level 4
At a CIP Intensity Level 4, the participant may feel comfortable supporting or implementing either a subject-matter or learning-based approach to instruction based on the content being addressed. In a subject-matter based approach, learning activities tend to be sequential, student projects tend to be uniform for all students, the use of lectures and/or teacher-directed presentations are the norm as well as traditional evaluation strategies. In a learner-based approach, learning activities are diversified and based mostly on student questions, the teacher serves more as a co-learner or facilitator in the classroom, student projects are primarily student-directed, and the use of alternative assessment strategies including performance-based assessments, peer reviews, and student reflections are the norm.

Intensity Level 5
At a CIP Intensity Level 5, the participant's instructional practices tend to lean more toward a learner-based approach. The essential content embedded in the standards emerges based on students "need to know" as they attempt to research and solve issues of importance to them using critical thinking and problem-solving skills. The types of learning activities and teaching strategies used in the learning environment are diversified and driven by student questions. Both students and teachers are involved in devising appropriate assessment instruments (e.g., performance-based, journals, peer reviews, self-

reflections) by which student performance will be assessed. However, the use of teacher-directed activities (e.g., lectures, presentations, teacher-directed projects) may surface based on the nature of the content being addressed and at the desired level of student cognition.

Intensity Level 6

Similar to a CIP Intensity Level 7, the participant at a CIP Intensity Level 6 supports instructional practices consistent with a learner-based approach, but not at the same level of intensity or commitment. The essential content embedded in the standards emerges based on students "need to know" as they attempt to research and solve issues of importance to them using critical thinking and problem-solving skills. The types of learning activities and teaching strategies used in the learning environment are diversified and driven by student questions. Students, teacher/facilitators, and occasionally parents are all involved in devising appropriate assessment instruments (e.g., performance-based, journals, peer reviews, self-reflections) by which student performance will be assessed.

Intensity Level 7

At a CIP Intensity Level 7, the participant's current instructional practices align exclusively with a learner-based approach to teaching and learning. The essential content embedded in the standards emerges based on students "need to know" as they attempt to research and solve issues of importance to them using critical thinking and problem-solving skills. The types of learning activities and teaching strategies used in the learning environment are diversified and driven by student questions. Students, teacher/facilitators, and occasionally parents are all involved in devising appropriate assessment instruments (e.g., performance-based, journals, peer reviews, self-reflections) by which student performance will be assessed.

(Learning Quest, 2006)

APPENDIX E

LOTI QUICK SCORING DEVICE

LoTi Quick Scoring Device

Box B - Enter Your Survey Responses Below

1 ___	26 ___
2 ___	27 ___
3 ___	28 ___
4 ___	29 ___
5 ___	30 ___
6 ___	31 ___
7 ___	32 ___
8 ___	33 ___
9 ___	34 ___
10 ___	35 ___
11 ___	36 ___
12 ___	37 ___
13 ___	38 ___
14 ___	39 ___
15 ___	40 ___
16 ___	41 ___
17 ___	42 ___
18 ___	43 ___
19 ___	44 ___
20 ___	45 ___
21 ___	46 ___
22 ___	47 ___
23 ___	48 ___
24 ___	49 ___
25 ___	50 ___

Box A - Identify Yourself

School Site: ____________________

Date: ____________________

Last 4 digits SS#: ____________________

Computer Access: Y_____ N_____

Box E - Graph Your Data

	Non-Use	Awareness	Exploration	Infusion	Integration (Mechanical)	Integration (Routine)	Expansion	Refinement	Personal Computer Use	Current Instructional Practices
Very True of Me Now 7										
6										
Somewhat True of Me Now 5										
4										
3										
Not True of Me Now 2										
1										
0	**0**	**1**	**2**	**3**	**4a**	**4b**	**5**	**6**	**PCU**	**CIP**

LoTi Rankings

Box C - Transcribe Your Scores

0	1	2	3	4a	4b	5	6	PCU	CIP
12 __	2 __	4 __	1 __	3 __	33 __	10 __	7 __	13 __	6 __
19 __	9 __	11 __	5 __	27 __	34 __	21 __	14 __	15 __	20 __
25 __	17 __	16 __	8 __	30 __	36 __	22 __	28 __	18 __	32 __
42 __	23 __	38 __	37 __	31 __	43 __	35 __	29 __	26 __	41 __
48 __	24 __	45 __	40 __	44 __	46 __	39 __	47 __	49 __	50 __

Box D - Enter Your Raw Scale Score Totals

__/5	__/5	__/5	__/5	__/5	__/5	__/5	__/5	__/5	__/5
0	**1**	**2**	**3**	**4a**	**4b**	**5**	**6**	**PCU**	**CIP**

Instructions:

Step 1: In Box A, fill in your identifying information (taken from the cover sheet of the LoTi Questionnaire).

Step 2: Copy the numerical values of your responses to statements 1-50 from the LoTi Questionnaire in the corresponding blanks in Box B.

Step 3: Transcribe the LoTi Questionnaire responses from Box B into the corresponding numbered blanks of Box C. Note that the numbered blanks in Box C are **not** in consecutive order.

Step 4: Box D contains the Raw Scale Score Total for each LoTi stage (0-6) as well as the Personal Computer Use (PCU) and Current Instructional Practices (CIP) scores. Total your scores for each column of Box C into the appropriate square in Box D. Each of these ten Raw Scale Score Totals will be a number between 0 and 35. Divide your Raw Scale Score Total by five.

Step 5: Box E contains the LoTi Ranking, PCU, and CIP graph. Graph each Raw Scale Score Total (divided by five) from Box D by shading in the appropriate column of Box E. When finished, you will have a profile that resembles a bar graph.

APPENDIX F

LOTI CALCULATION KEY

LoTi Calculation Key

After determining the variables using the LoTi Quick Scoring device, apply the following rules to determine a participant's final LoTi Score.

If *Computer Access?* is *FALSE*, **LoTi Score = 0**

If *Highest Raw LoTi Score* is < *6*, **LoTi Score = 0**

If *Highest Raw LoTi Score* is < *10* and *Highest Raw LoTi Score* is ≥ *6*, **LoTi Score = 1**

If *Highest Raw LoTi Score* is < *15* and *Highest Raw LoTi Score* is ≥ *10*, **LoTi Score = 2**

If *Highest Raw LoTi Score* is ≥ *30* and *Highest Level* is ≥ *6* and *PCU* is ≥ *30* and *CIP* is ≥ *30*, **LoTi Score = 6**

If *Highest Raw LoTi Score* is ≥ *25* and *Highest Level* is ≥ *5* and *PCU* is ≥ *25* and *CIP* is ≥ *25*, **LoTi Score = 5**

If *Highest Raw LoTi Score* is ≥ *25* and *Highest Level* is ≥ *5* and (*PCU* is ≥ *20* and *PCU* is < *25*) and (*CIP* is ≥ *20* and *CIP* is < *25*), **LoTi Score = 4b**

If *Highest Raw LoTi Score* is ≥ *25* and *Highest Level* is ≥ *4b* and *PCU* is ≥ *20* and *CIP* is ≥ *25*, **LoTi Score = 4b**

If *Highest Raw LoTi Score* is ≥ *25* and *Highest Level* is ≥ *4b* and (*PCU* is ≥ *15* and *PCU* is < *20*) and (*CIP* is ≥ *20* and *CIP* is < *25*), **LoTi Score = 4a**

If *Highest Raw LoTi Score* is ≥ *20* and *Highest Level* is ≥ *4a* and *PCU* is ≥ *15* and *CIP* is ≥ *20*, **LoTi Score = 4a**

If *Highest Raw LoTi Score* is ≥ *20* and *Highest Level* is ≥ *4a* and *PCU* is ≥ *15* and (*CIP* is ≥ *15* and *CIP* is < *20*), **LoTi Score = 3**

If *Highest Raw LoTi Score* is ≥ *15* and *Highest Level* is ≥ *3* and *PCU* is ≥ *15*, **LoTi Score = 3**

If *Highest Raw LoTi Score* is ≥ *15* and *Highest Level* is ≥ *3* and *PCU* is < *15*, **LoTi Score = 2**

If *Highest Raw LoTi Score* is ≥ *15* and *Highest Level* is ≥ *2*, **LoTi Score = 2**

If *Highest Raw LoTi Score* is ≥ *15* and *Highest Level* is ≥ *1*, **LoTi Score = 1**

If *Highest Raw LoTi Score* is ≥ *15* and *Highest Level* is ≥ *0*, **LoTi Score = 0**

If *Highest Raw LoTi Score* is < *15* and *Highest Level* is < *3*, **LoTi Score =** Hi_LoTiLevel,

If *Highest Raw LoTi Score* is < *15* and *Highest Level* is ≥ *3*, **LoTi Score = 2, LoTi Score = 1, LoTi Score = 0**

Highest Raw LoTi Score = The highest raw score from the LoTi categories (0,1,2,3,4a,4b,5,6). If two categories have the same highest raw score, use the higher category's score to apply the rules.

Computer Access? = Does the participant have computer access? If not, participants are automatically at LoTi Level 0 because they can not implement computers without access to them.

Highest Level = The LoTi category (0,1,2,3,4a,4b,5,6) that had the highest raw loti score is the Highest Level.

APPENDIX G

CERTIFICATION FIELDS BASED ON CURRENT TEACHING CERTIFICATES ISSUED BY THE PSC

Certification fields based on current teaching certificates issued by the PSC

Field	Certification		
Teaching Field	Agriculture	Greek	Mental Retardation
	Art	Health	Middle Grades
	Behavior Sciences	Health Occupations	Music
	Biology	Health and Physical Education	Orthopedically Impaired
	Business	Hearing Impaired	Physics
	Chemistry	Hebrew	Political Science
	Chinese	History	Reading Specialist
	Dance	Family and Consumer Science	Russian
	Early Childhood	Interrelated Special Education	Science
	Earth/Space Science	Interrelated/Early Childhood	Social Science
	Economics	Italian	Spanish
	Elementary Grades	Japanese	Speech
	English	Latin	Technology Education
	French	Learning Disabilities	Trade & Industrial Education
	Geography	Marketing	Visually Impaired
	German	Mathematics	
Service	Audiology	School Psychology	
	Media Specialist	School Social Work	
	School Counseling	Speech & Language Pathology	
	School Nutrition Director		
Leadership	Educational Leadership		

APPENDIX H

PERMISSION TO REPLICATE THE LOTI QUESTIONNAIRE AND TABLES REGARDING THE LEVELS OF TECHNOLOGY IMPLEMENTATION (LOTI) FRAMEWORK AND STAGES OF INSTRUCTIONAL PRACTICES

From: Chris Moersch <chris@learning-quest.com> Add to Address Book
Date: 2005/04/02 Sat PM 12:26:17 EST
To: <lisalemoine@bellsouth.net>
Subject: Re: Re: LoTi Questionnaire

Lisa,

Yes, you have my permission. No problem.

Chris Moersch

>Dissertation Chair - Elaine Adams
>Institution - University of Georgia, Department of Occupational Studies
>
>I need to clarify my original request. Do I have your permission to
>replicate/reprint the LoTiQ along with the tables regarding The
>Levels of Technology Implementation (LoTi) Framework and Stages of
>Instructional Practices?
>>
>> From: Chris Moersch <chris@learning-quest.com>
>> Date: 2005/03/24 Thu AM 08:49:05 EST
>> To: <lisalemoine@bellsouth.net>
>> Subject: Re: LoTi Questionnaire
>>
>> Lisa,
>>
>> No problem with that. I need additional information:
>>
>> Dissertation Chair
>> Institution
>> Dissertation Summary
>>
>> I would also like to have a summary of your results when you are done.
>>
>> Chris Moersch
>>
>> >Dear Mr. Moersch,
>> >
>> >I am a doctoral student at the University of Georgia in the
>> >department of Occupational Studies. For my research study, I am
>> >investigating the impact of two mandatory technology-staff
>> >development programs on the level of technology implementation for
>> >public school teachers in the State of Georgia. I am interested in
>> >using your LoTi Questionnaire as my instrument. I understand that
>> >the questionnaire is copyrighted. With your permission, could I use
>> >the LoTiQ along with the tables regarding The Levels of Technology
>> >Implementation (LoTi) Framework and Stages of Instructional
>> >Practices? Should I need to make any modifications to the
>> >instrument, what would you require of me?
>> >
>> >Sincerely,
>> >Lisa LeMoine
>>
>>

APPENDIX I

UNIVERSITY OF GEORGIA INSTITUTIONAL REVIEW BOARD APPROVAL TO CONDUCT STUDY

The University of Georgia

Office of The Vice President for Research
DHHS Assurance ID No. : FWA00003901

Institutional Review Board
Human Subjects Office
612 Boyd GSRC
Athens, Georgia 30602-7411
(706) 542-3199
Fax: (706) 542-5638
www.ovpr.uga.edu/hso

APPROVAL FORM

Date Proposal Received: 2007-03-01 **Project Number:** 2007-10584-0

Name	Title	Dept/Phone	Address	Email
Ms. Lisa Lemoine	PI	Workforce Education River's Crossing, 4809	7442 Fireside Lane Flowery Branch, GA 30542 770-271-3142	llemoine@uga.edu
Dr. Joyce Elaine Adams	CO	Workforce Education, Leadership, and Social Foundations River's Crossing +4809 542-4204		adamsje@uga.edu

Title of Study: Identification of Predictors of Level of Technology Implementation

45 CFR 46 Category: Administrative 2
Parameters:
Informed Consent Documented via Informational/Cover Letter

Change(s) Required for Approval:
Revised Application;
Revised Consent Document(s);

Approved : 2007-03-13 Begin date : 2007-03-13 Expiration date : 2012-03-12

NOTE: Any research conducted before the approval date or after the end data collection date shown above is not covered by IRB approval, and cannot be retroactively approved.

Number Assigned by Sponsored Programs:

Funding Agency:

Form 310 Provided: No

Your human subjects study has been approved.

Please be aware that it is your responsibility to inform the IRB:
. . . of any adverse events or unanticipated risks to the subjects or others within 24 to 72 hours;
. . . of any significant changes or additions to your study and obtain approval of them before they are put into effect;
. . . that you need to extend the approval period beyond the expiration date shown above;
. . . that you have completed your data collection as approved, within the approval period shown above, so that your file may be closed.

For additional information regarding your responsibilities as an investigtor refer to the IRB Guidelines.
Use the attached Researcher Request Form for requesting renewals, changes, or closures.
Keep this original approval form for your records.

Chairperson or Designee,
Institutional Review Board

APPENDIX J

LOCAL SCHOOL SYSTEM APPROVAL TO CONDUCT STUDY

437 Old Peachtree Road NW
Suwanee, GA
30024-2978
678.301.6000
www.gwinnett.k12.ga.us

October 2, 2006

Ms. Lisa LeMoine
7442 Fireside Lane
Flowery Branch GA 30542

Dear Ms. LeMoine:

This is to advise you that your research proposal, "The Impact of Technology-Professional Development Programs on Teachers' Levels of Technology Implementation", File ID Number 2007-10, has been approved with the following limitations:

- The cover letter, and possibly the introductory material, for the LoTI questionnaire should be revised to assure teacher participants of the confidentiality of their responses. Statements concerning the use of the results to inform school and district practices should be revised to assure teachers that it will be the aggregated results of all surveys that will inform school and district practices rather than any revelation of individual teachers' responses.

Important: When contacting schools regarding this research, it is your responsibility to provide a copy of this approval letter to the principal. In addition, it is your responsibility to provide your sponsors and project officers or managers with a copy of this approval letter. It is important that you use the file ID number issued above when contacting schools or district level personnel regarding this research study.

Please note that schools and teachers may elect not to participate in your research study, even though the district has granted permission.

Please forward a copy of your results to me when they are completed. Also, we would appreciate you providing us with some feedback on the research approval process by completing the enclosed survey and returning it in the enclosed postage-paid envelope.

Best wishes for a successful research project. Please call me at (678) 301-7091 if I may be of further assistance.

Sincerely,

Colin Martin

Colin Martin, Ph.D., Director
Research and Accountability

Enclosure

Colin Martin/Research and Evaluation/GCPS

12/14/2006 12:26 PM

To Lisa LeMoine/Sycamore Elementary/GCPS@GCPS

cc Pat Bridwell

bcc

Subject Re: Research Approval Question

Lisa, this note will serve as approval for the changes to your study that you have listed below. You need not submit a new proposal. Good luck with the completion of your work, and let me know if there is anything I can do to help.

Colin

****
Colin Martin, Ph.D.
Director of Research and Evaluation
Division of Academic Support
Gwinnett County Public Schools
Instructional Support Center, Suite 1.201
437 Old Peachtree Road NW
Suwanee, GA 30024-2978
Phone 678-301-7090
Fax 678-301-7088
****

Lisa LeMoine/Sycamore Elementary/GCPS

Lisa LeMoine/Sycamore Elementary/GCPS

12/14/2006 11:47 AM

To Colin Martin/Research and Evaluation/GCPS@GCPS

cc

Subject Research Approval Question

I have previously completed the research approval process File ID # 2007-10. As of last week, my doctoral committee requested that I make the following changes to my study:

Previous Version	New Version
Title: The Impact of Technology Professional Development Programs on Teachers' Levels of Technology Implementation	Title: Identification of Predictors of Level of Technology Implementation
Population: Certified Teachers who have completed GTAT	Population: All Certified Teachers
Independent Variables: Age, Gender, Grade Level Teaching Assignment	Independent Variables: Method of meeting the technology requirement for recertification, certification field, grade level, age, gender
Data Analysis: ANOVA	Data Analysis: Multiple Regression

Do I need to go through the research approval process again? Please advise me on the correct procedure.

Thank you for your assistance,

Lisa LeMoine
Technology Coordinator

APPENDIX K

COVER LETTER FOR STUDY

March 20, 2007

Dear Survey Participant

I am currently a Local School Technology Coordinator (LSTC) at Sycamore Elementary School and a doctoral student at the University of Georgia. As part of my doctoral program, I am conducting a survey of randomly selected teachers from Gwinnett County and am requesting your voluntary participation in my research study. You may decline to participate or stop at any time without penalty, or skip any questions you feel uncomfortable answering. No risk is expected.

I am using the LoTi Questionnaire (LoTiQ) survey instrument to complete my research study. The purpose of this questionnaire is to determine your current level of technology implementation (LoTi) in the classroom as well as your personal computer use (PCU), and current instructional practices (CIP). Completing the questionnaire will enable your school and county to make appropriate choices regarding professional development and future technology purchases. The questionnaire statements were developed from typical responses of educators who ranged from non-user to sophisticated users of computers. Questionnaire statements will represent different uses of computers that you currently experience, in varying degrees of intensity, and should be recorded appropriately on the scale.

This survey will take approximately 20 minutes to complete. When you have completed your survey, please return it in its entirety to me in the enclosed self-addressed courier envelope **within 10 days of receipt**. If you have any questions about the study, either now or at a later date, please do not hesitate to ask. You may contact Lisa LeMoine at llemoine@uga.edu.

Answers will remain confidential, as I am interested in the data in aggregate only and not individual responses. Information, as it relates to you, will not be shared. Thank you in advance for your participation. Your time is greatly appreciated!

Sincerely,

Lisa LeMoine
Ed.D. Candidate

Additional questions or problems regarding your rights as a research participant should be addressed to The Chairperson, Institutional Review Board, University of Georgia, 612 Boyd Graduate Studies Research Center, Athens, Georgia 30602-7411; Telephone (706) 542-3199; E-Mail Address IRB@uga.edu

APPENDIX L

LEVEL OF TECHNOLOGY IMPLEMENTATION (LOTI) QUESTIONNAIRE

Level of Technology Implementation (LoTi) Questionnaire

Version 5.0

Inservice Teachers

LoTi Questionnaire

The following information has been requested as part of an ongoing effort to increase the Level of Technology Implementation in schools nationwide. Individual information will remain anonymous, while the aggregate information will provide various comparisons for your school, school district, regional service agency, and/or state within the LoTi Technology Use Profile. Please fill out as much of the information as possible.

The LoTi Questionnaire (LoTiQ) takes about 20-25 minutes to complete. The purpose of this questionnaire is to determine your Level of Technology Implementation (LoTi) based on your current position (i.e., pre-service teacher, inservice teacher, building administrator, instructional specialist, media specialist, higher education faculty) as well as your perceptions regarding your Personal Computer Use (PCU), and Current Instructional Practices (CIP).

THIS IS NOT A TEST!

Completing the questionnaire will enable your educational institution to make better choices regarding staff development and future technology purchases. The questionnaire statements were developed from typical responses of educators who ranged from non-user to sophisticated users of computers. Questionnaire statements will represent different uses of computers that you currently experience or support, in varying degrees of intensity, and should be recorded appropriately on the scale. Please respond to the statements in terms of your present uses or support of computers in the classroom. For statements that are Not Applicable to you, please select a "0" response on the scale.

* Indicates that this information is required to correctly process your data.

Do you have computer access at school?*

☐**Yes**

☐**No**

Computer access means that students and teachers can use computers within the school building for instructional computer labs, computers on carts, general access computers in the Library or something similar.

LoTi Questionnaire

Read each response and assign a score based on the following scale:

0	1	2	3	4	5	6	7
N/A	Not true of me now		Somewhat true of me now			Very true of me now	

1 Score __________
I frequently engage students in learning activities that require them to analyze information, think creatively, make predictions, and/or draw conclusions using the classroom technology resources.

2 Score __________
I frequently present information to students using multimedia presentations or electronic "slideshows" to reinforce the content standards that I am teaching and better prepare students to take standardized tests.

3 Score __________
I have trouble managing a student-centered classroom using the available technology resources and would welcome the help of a peer coach or mentor.

4 Score __________
Students in my classroom design either web-based or multimedia presentations to showcase their research (e.g., information gathering) on topics that I assign in class.

5 Score __________
I frequently assign web-based projects to my students as a means of emphasizing specific complex thinking skill strategies aligned to the content standards.

6 Score __________
My students collaborate with me in setting both group and individual academic goals that provide opportunities for them to direct their own learning aligned to the content standards.

7 Score __________
Using the most current and complete technology infrastructure available, I have maximized the use of the learning technologies in my classroom and at my school.

8 Score __________
Problem-based learning is common in my classroom because it allows students to use the classroom technology resources as a tool for higher-order thinking and personal inquiry.

9 Score __________
I use the classroom technology resources exclusively to take attendance, record grades, present content to students, and/or communicate with parents via email.

LoTi Questionnaire

Read each response and assign a score based on the following scale:

0	1	2	3	4	5	6	7
N/A	Not true of me now		Somewhat true of me now			Very true of me now	

10 Score __________
My students identify important school/community issues or problems, then use multiple technology resources as well as human resources beyond the school building (e.g., partnerships with business professionals, community groups) to solve them.

11 Score __________
My students use the classroom technology resources most frequently to improve their basic math and literacy skills via practice testing software, integrated learning systems (ILS), or tutorial programs.

12 Score __________
Constant technical problems prevent me and/or my students from using the classroom technology resources during the instructional day.

13 Score __________
I am proficient with basic software applications such as word processing tools, internet browsers, spreadsheet programs, and multimedia presentations.

14 Score __________
My students frequently discover innovative ways to use our school's advanced learning technologies to make a real difference in their lives, in their school, and in their community.

15 Score __________
I can solve most technical problems with our classroom's technology resources during the instructional day without calling for technical assistance.

16 Score __________
Locating quality software programs, websites, or CD's to supplement my curriculum and reinforce specific content standards is a priority of mine at this time.

17 Score __________
Though I may use technology for teacher preparation, I am not comfortable using my classroom technology resources as part of my instructional day.

18 Score __________
I am comfortable training others in using basic software applications, browsing/searching the Internet, and using specialized technologies unique to my grade level or content area.

19 Score __________
Computers and related technology resources in my classroom are not used during the instructional day, nor are there any plans to include them at this time.

LoTi Questionnaire

Read each response and assign a score based on the following scale:

0	1	2	3	4	5	6	7
N/A	Not true of me now		Somewhat true of me now			Very true of me now	

20 Score __________
I consistently provide alternative assessment opportunities that encourage students to "showcase" their understanding of the content standards in nontraditional ways.

21 Score __________
My students use the Internet for (1) collaboration with others, (2) publishing, (3) communication, and (4) research to solve issues and problems of personal interest that address specific content standards.

22 Score __________
My students participate in online collaborative projects (not including email exchanges) with other students, government agencies, or business professionals to solve their self-selected problems or issues.

23 Score __________
Given my current curriculum demands and class size, it is much easier and more practical for my students to learn about and use computers and related technology resources outside of my classroom (e.g., computer lab, resource center).

24 Score __________
I use the classroom technology resources most frequently to locate lesson plans I can use in class that are appropriate to my grade level and are aligned with our content standards.

25 Score __________
My current instructional program is effective without the use of technology; therefore, I have no current plans to change it to include any technology resources.

26 Score __________
I use our technology resources daily to access the Internet, send email, and/or plan classroom activities.

27 Score __________
Due to time constraints and/or lack of experience, I prefer using instructional units recommended by my colleagues that emphasize complex thinking skills, student technology use, content standards, and student relevancy to the real world.

28 Score __________
My students creative thinking and authentic problem-solving opportunities are supported by the most advanced and complete technology infrastructure available.

29 Score __________
My personal professional development involves investigating and implementing the newest innovations in instructional design and learning technologies that take full advantage of my school's most current and complete technology infrastructure.

LoTi Questionnaire

Read each response and assign a score based on the following scale:

0	1	2	3	4	5	6	7
N/A	Not true of me now		Somewhat true of me now			Very true of me now	

30 Score __________
I can locate and implement instructional units that emphasize students using the classroom technology resources to solve "real-world" problems or issues, but I don't usually create them myself.

31 Score __________
I have an immediate need for some outside help with designing student-centered performance assessments using the available technology that involve students applying what they have learned to make a difference in their school/community.

32 Score __________
Students' use of information and inquiry skills to solve problems of personal relevance guides the types of instructional materials used in and out of my classroom.

33 Score __________
My instructional use of our classroom technology resources is frequently altered according to the latest innovations and research in the areas of instructional technology, teaching strategies, and/or learning theory.

34 Score __________
I regularly implement a student-centered approach to teaching that takes advantage of our classroom technology resources to engage students in their own learning.

35 Score __________
I frequently consider (1) my students interests, experiences, and desire to solve relevant problems and (2) the available human resources outside of the school when planning student-centered learning activities that include technology.

36 Score __________
Students taking meaningful action at school or in the community relating to the content standards learned in class is an essential part of my approach to using the classroom technology resources.

37 Score __________
I have an immediate need for professional development opportunities that place greater emphasis on using my classroom technology resources with challenging and differentiated learning experiences rather than using specific software applications to support my current lesson plans.

38 Score __________
My students create their own web pages or multimedia presentations to showcase what they have learned in class rather than preparing traditional reports.

39 Score __________
The types of professional development offered through our school system does not satisfy my need for more engaging and relevant experiences for my students that take full advantage of both my "technology" expertise and personal interest in developing learner-based curriculum units.

LoTi Questionnaire

Read each response and assign a score based on the following scale:

0	1	2	3	4	5	6	7
N/A	Not true of me now		Somewhat true of me now			Very true of me now	

40 Score __________
My students frequently use the classroom technology resources for research purposes that require them to investigate an issue/problem, think creatively, take a position, make decisions, and/ or seek out a solution.

41 Score __________
Having students apply what they have learned in my classroom to the world they live in is a cornerstone to my approach to instruction and assessment.

42 Score __________
Curriculum demands, scheduling, and/or budget constraints at our school have prevented me from using any of the available technology resources during the instructional day.

43 Score __________
I am skilled in merging the classroom technology resources with relevant and challenging, student-directed learning experiences that address the content standards.

44 Score __________
Though I currently use a student-centered approach when creating instructional units, it is still difficult for me to design these units on my own to take full advantage of our classroom technology resources.

45 Score __________
My immediate professional development need is to learn how my students can use our classroom technology resources to achieve specific outcomes aligned to the content standards.

46 Score __________
It is easy for me to identify and implement software applications, peripherals, and web-based resources that support student' complex thinking skills and promote self-directed problem solving.

47 Score __________
My students have immediate access to all forms of the most advanced and complete technology infrastructure available that they use to pursue problem-solving opportunities surrounding issues of personal and/or social importance.

48 Score __________
I need access to more resources and/or training to begin using the available technology resources as part of my instructional day.

49 Score __________
I regularly use different technology resources for personal or professional communication and planning.

50 Score __________
Students' questions and previous experiences heavily influence the content that I teach as well as how I design learning activities for my students.

Demographic Information

A. Method of completing the technology requirement for recertification

__________ Test-out portfolio
__________ ITT
__________ AssessOnline
__________ Other
__________ None (I have not completed the technology requirement for recertification)

B. Certification field based on current teaching certificate issued by the PSC

***Teaching Fields*:**

__________ Agriculture
__________ Art
__________ Behavior Sciences
__________ Biology
__________ Business
__________ Chemistry
__________ Chinese
__________ Dance
__________ Early Childhood
__________ Earth/Space Science
__________ Economics
__________ Elementary Grades
__________ English
__________ French
__________ Geography
__________ German
__________ Greek
__________ Health
__________ Health Occupations
__________ Health and Physical Education
__________ Hearing Impaired
__________ Hebrew
__________ History
__________ Family and Consumer Science
__________ Interrelated Special Education
__________ Interrelated / Early Childhood
__________ Italian
__________ Japanese
__________ Latin
__________ Learning Disabilities
__________ Marketing
__________ Mathematics
__________ Mental Retardation
__________ Middle Grades
__________ Music
__________ Orthopedically Impaired
__________ Physics
__________ Political Science
__________ Reading Specialist
__________ Russian
__________ Science
__________ Social Science
__________ Spanish
__________ Speech
__________ Technology Education
__________ Trade & Industrial Education
__________ Visually Impaired

***Service Fields*:**

__________ Audiology
__________ Media Specialist
__________ School Counseling
__________ School Nutrition Director
__________ School Psychology
__________ School Social Work
__________ Speech and Language Pathology

***Leadership Field*:**

__________ Educational Leadership

C. Grade Level Teaching Assignment

__________ Elementary School
__________ Middle School
__________ High School
__________ Multiple Grade Levels
__________ All Grade Levels (K-12)

D. Age in Years Based on Last Birthday __________________

E. Gender: _____________ Male _____________ Female

APPENDIX M

FOLLOW-UP POSTCARD FOR STUDY

March 27, 2007

Last week, you received the LoTi Questionnaire. If you have already completed and returned the LoTi Questionnaire to me please accept my sincere appreciation. If not, I would appreciate you taking the time to do so today. The survey has only been sent to a small random sample of eligible teachers. Therefore, your contribution is extremely important to the accuracy of the data set representing the opinions of Gwinnett County teachers.

If by some chance you did not receive the LoTi Questionnaire, or it has been misplaced, please email me through Lotus Notes and I will send another one in the courier to you today.

Sincerely,

Lisa LeMoine
Ed.D. Candidate
University of Georgia

APPENDIX N

SECOND FOLLOW-UP COVER LETTER FOR STUDY

April 10, 2007

Dear Survey Participant:

Approximately three weeks ago, I wrote to you seeking your opinion regarding your current level of technology implementation (LoTi) in the classroom as well as your personal computer use (PCU), and current instructional practices (CIP). As of today, I have not yet received your completed questionnaire.

I have undertaken this research study to provide school and county technology professional development leaders the data needed to make appropriate choices regarding professional development and future technology purchases.

I am writing to you again because of the significance each questionnaire has to the usefulness of this study. For the results of this study to be truly representative of the opinions of all Gwinnett County teachers, it is essential that each individual in the sample return his or her questionnaire.

As I previously mentioned, answers will remain confidential, as I am interested in the data only in aggregate and not individual responses. Information, as it related to you, will not be shared. If by chance your questionnaire has been misplaced, a replacement is enclosed. Thank you for your participation. Your time is greatly appreciated!

Sincerely,

Lisa LeMoine
Ed.D. Candidate

APPENDIX O

THIRD FOLLOW-UP COVER LETTER FOR STUDY

May 8, 2007

Dear Survey Participant:

I am writing to you about the technology study regarding your current level of technology implementation (LoTi) in the classroom as well as your personal computer use (PCU), and current instructional practices (CIP). As of today, I have not yet received your completed questionnaire.

How accurately I can describe the opinions of Gwinnett County teachers depends upon you and the others who have not yet responded. May I urge you to complete and return the LoTi Questionnaire as quickly as possible.

As I previously mentioned, answers will remain confidential, as I am interested in the data only in aggregate and not individual responses. Information, as it related to you, will not be shared. If by chance your questionnaire has been misplaced, a replacement is enclosed.

Your contribution to the success of this study is greatly appreciated!

Sincerely,

Lisa LeMoine
Ed.D. Candidate

APPENDIX P

FREQUENCY TABLE FOR AGES OF PARTICIPANTS

Frequency Table for Age

Age	Frequency	Percent
23	3	0.8
24	13	3.6
25	10	2.7
26	11	3.0
27	9	2.5
28	8	2.2
29	12	3.3
30	9	2.5
31	8	2.2
32	11	3.0
33	7	1.9
34	8	2.2
35	12	3.3
36	9	2.5
37	5	1.4
38	13	3.6
39	9	2.5
40	7	1.9
41	11	3.0
42	13	3.6
43	7	1.9
44	5	1.4
45	11	3.0

46	13	3.6
47	6	1.6
48	9	2.5
49	12	3.3
50	9	2.5
51	6	1.6
52	11	3.0
53	8	2.2
54	10	2.7
55	11	3.0
56	10	2.7
57	14	3.8
58	10	2.7
59	8	2.2
60	7	1.9
61	2	0.5
62	4	1.1
65	1	0.3
66	1	0.3
67	2	0.5
Total	365	100.0%