CEC Theses and Dissertations | College of Engineering and Computing

2010

Assistive Technology Attrition: Identifying Why Teachers Abandon Assistive Technologies

Michael Edward Sharpe
Nova Southeastern University, mesharpe@drmesharpe.com

This document is a product of extensive research conducted at the Nova Southeastern University College of Engineering and Computing. For more information on research and degree programs at the NSU College of Engineering and Computing, please click here.

Follow this and additional works at: https://nsuworks.nova.edu/gscis_etd

Part of the Computer Sciences Commons

Share Feedback About This Item

Assistive Technology Attrition:
Identifying Why Teachers Abandon Assistive
Technologies

by

Michael E. Sharpe

A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
in
Computing Technology in Education

Graduate School of Computer and Information Sciences
Nova Southeastern University

2010

We hereby certify that this dissertation, submitted by Michael E. Sharpe, conforms to acceptable standards and is fully adequate in scope and quality to fulfill the dissertation requirements for the degree of Doctor of Philosophy.

_____   _____
Laurie P. Dringus, Ph.D   Date
Chairperson of Dissertation Committee

_____   _____
Steven R. Terrell, Ed.D.   Date
Dissertation Committee Member

_____   _____
Martha M. Snyder, Ph.D.   Date
Dissertation Committee Member

Approved:

_____   _____
Leonides Irakliotis, Ph.D.   Date
Dean

Graduate School of Computer and Information Sciences
Nova Southeastern University

2010

An Abstract of a Dissertation Submitted to Nova Southeastern University in Partial
Fulfillment of the Requirements for the Degree of Doctor of Philosophy

Assistive Technology Attrition:
Identifying Why Teachers Abandon Assistive
Technologies

by
Michael E. Sharpe

May 2010

The study surveyed a sample of K-12 teachers who had used assistive technology (AT) in
the classroom to determine answers to five research questions. These were, (1) why the
teachers adopted AT, (2) their attitudes and perceptions about its value, (3) challenges
they have experienced in adopting AT, (4) whether they have discontinued or decreased
use of AT, and, if so, (5) the factors that led to this result.

The study used both quantitative and qualitative methods. For the quantitative aspect, an
online survey instrument was developed to answer five research questions. Participants
were teachers who had used AT in the classroom and came from 19 Georgia school
districts whose superintendents granted permission for them to participate and whose
assistant technology coordinators agreed to inform teachers in their districts' schools of
the study. A total of 174 teachers completed the online survey. Of these, 52 agreed to be
interviewed by telephone by the researcher, and 10 of those were randomly selected to be
interviewed. Telephone interviews were audio recorded with the interviewee's
permission, then transcribed by the researcher.

Analysis of quantitative results included factor analysis of replies to Likert-scaled items,
compilation of frequency of responses, and determination of means for Likert items. For
interview responses, qualitative methods were used to determine any themes in
participants' replies.

It was found that (1) the most prevalent reason teachers initially used AT is that they
perceived that the technology has value for their students, (2) the teachers had a mostly
positive attitude toward the value of AT, (3) most of the teachers reported needing more
training in AT, (4) almost half felt that time constraints affected their use of AT, (5) about
one-third of online responders and 9 of 10 interviewees agreed that technical problems
affected their use of AT, and (6) less than half of online participants perceived that they
had adequate AT support. It was also found that most of the teachers had neither
decreased nor discontinued use of AT during the 2008-2009 school year. Reasons cited
by those who had decreased or discontinued use included time constraints, technical
problems, lack of training, and lack of support.

Acknowledgments

God has led me and has given me the strength and support through those around me to get to this point of high achievement. My mother, to whom I dedicate this dissertation, deserves the lion's share of the credit for my completion of this project through her encouragement and unfaltering support. She was my reader and advisor, and though she suffered significant health difficulties, she has persevered in her support to help me attain this goal. It is also with heartfelt gratitude that I offer appreciation to my family members and the teachers that I have had the pleasure to work with for their words of affirmation.

It was Jack Kinder who said that high achievement always takes place in the framework of high expectation. I am appreciative of my committee members, who have guided me with their high expectations toward the attainment of my goal. Dr. Laurie Dringus has been both a supporter and a mentor for me in this project. From the first class of the doctoral program through the dissertation, she has guided my scholarly development. I want to express my deep appreciation to Dr. Terrell, who I consider a friend as well as my professor, for the foundation of research that he imparted. My association with him has given me a base of knowledge that has provided growth. I express my gratitude to Dr. Snyder, whose enthusiastic influence and gentle guidance furthered the development of my scholarly writing skills. Her direction has been influential not only in the collegiate arena but also in my professional and business writing.

My success and much of my inspiration has come from these individuals who have surrounded me throughout my journey, and for that I am most grateful.

Table of Contents

List of Tables

Tables

Chapter 1

Introduction

Background and Overview

Computer technologies have evolved in recent years. The capacity of software and hardware to be used for targeted application in the nation's classrooms has increased exponentially (Figura & Jarvis, 2007; Ozel, Ebrar Yetkiner, & Capraro, 2008). These applications include devices and programs that have come to be termed "assistive technologies" have been introduced in classrooms with the specific purpose of enhancing learning opportunities for students, especially those with learning or physical disabilities (McNaughton et al., 2008). According to the federal Individuals with Disabilities Education Act (IDEA), the term *assistive technology* refers to "any item, piece of equipment, or product system, whether acquired commercially off-the-shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of individuals with disabilities" (U.S. Department of Education, n.p., 2004).

The potential value of assistive technologies for improving the learning potential of disabled students has been recognized by the federal government. Recent legislation has mandated that public schools make provisions for disabled students by ensuring that appropriate assistive technologies are made available to mitigate the negative learning effects of certain disabilities (National Center for Learning Disabilities, 2007). President Bush's No Child Left Behind Act (NCLB) affirms the need for assistive technologies in the nation's classrooms, pushing for evidence-based practices and resources that could

result in improved academic and performance outcomes for all students, including those with disabilities. As a result of the NCLB Act and other educational policies introduced by the federal government over the past eight years, more technology is available in the country's classrooms (Underwood, Smith, Luckin, & Fitzpatrick, 2008). The NCLB Act and IDEA legislation also established policies about how and by whom this technology should be used (Lynch & Adams, 2008; Roach & Frank, 2007).

Although the mandates of federal legislation have been the most influential factor determining the adoption of assistive technologies in American classrooms, they are not the only factor. Another impetus has been the enthusiasm of the public for computer-based technologies and from parents who hope that assistive technologies will revolutionize learning for their children (Telem & Pinto, 2006). As a result of pressure from these stakeholder groups, school administrators and teachers rushed to make assistive technologies available in their classrooms and to adapt their instructional strategies to include the use of such technologies (Esposito, 2008; Peck & Scarpati, 2006). Parents are not always in favor of assistive technology, and sometimes parents and students resist the efforts of the school to implement assistive technology. Osborne (2004) states several legal precedents in which the school was pushing to implement assistive technology and the family refused. The courts ruled in the favor of the families in each case Lahm (2002). A third important factor influencing the acceptance of assistive technology is the findings of researchers and academicians. For example, Forgrave (2002) presented evidence that the efficacy of assistive technology tools in concert with instructional techniques serves to improve students' academic strengths and

compensate for their disabilities. This research accounts for the additional value of assistive technology to increase students' self-esteem, motivation, and self-efficacy.

Despite the initial wave of enthusiasm, the abandonment rate in the use of adopted assistive technologies has been quite high (Verza, Carvalho, Lopez, Battaglia, & Uccelli, 2006; Wessels, Dijcks, Soede, Gelderblom, & De Witte, 2003). Abandonment occurs when an assistive technology is accepted by being purchased, but then it either goes unused or it is discontinued after a period of use. Shortly after the implementation of classroom technologies, Phillips and Zhao (1993) reported that the abandonment rate was at least 29%. More recent research has indicated that the current abandonment rate may be far higher, even as high as 75–80% (Ebner, 2004; Verza et al., 2006). Cuban, Kirkpatrick, and Peck (2001) observed that in spite of federal mandates and the assumption that "wiring schools, buying hardware and software, and distributing the equipment throughout will lead to abundant classroom use by teachers and students and improved teaching and learning," most schools embody the description "high access" and "low use" (p. 813). Cuban et al. (2001) pointed out that the widespread availability of technology and the poor use of technology have created one of the most perplexing paradoxes of the contemporary education system.

Further confounding the problem, according to Lahm (2002), the field of assistive technology has developed an expertise and affordability to make assistive technology available to all people. The structure of services in the K-12 school system includes the educational team, which is comprised of the teacher, school administration, and the parents. The team has expertise available such as Occupational and Physical Therapists in addition to Assistive Technology Specialists and engineers who provide intensive

evaluations and offer recommendations individualized to the specific student's needs. It is the expertise that unfortunately is unexploited. According to Netherton and Deal (2006) teachers have the skills, knowledge, and resources to implement assistive technology in their classrooms but they need to be continually provided information and direction to do so. These authors suggest that through teacher training and in-service workshops, students can increase participation in their education and become more independent.

Problem Statement and Goal

The abandonment rate for assistive technologies in schools is high, but the reasons these technologies are often discontinued are not well understood. This includes a lack of understanding of why teachers, who introduce assistive technologies to users and who retain the decision-making authority about how and how much they are utilized, sometimes discontinue their use (Bender Pape, Kim, & Weiner, 2002; Mansmann & Scholl, 2007). Most existing literature on the subject of assistive technology abandonment focuses on actual users of the equipment, namely the person with the disability rather than the technology decision makers and gatekeepers (Mansmann & Scholl; Temple, 2006). Understanding why teachers abandon AT is important because they, not the students who may benefit from the technology, are the ones who control whether AT is used in the classroom. Even if a student's Individualized Educational Program (IEP) mandates the use of assistive technology and it is available, the teacher may decide not to implement the technology, to stop using it, or to limit its use.

It is important to know whether the factors that motivate teachers to abandon assistive technologies are different from the factors that contribute to users' abandonment

of assistive technologies that have been established by researchers such as Phillips and Zhao (1993) and Ebner (2004). The answer to this question will determine policy and practice interventions. Some of the implications of a high attrition and abandonment rate include unnecessary expenses for schools that invest in such technologies and then discontinue their use (Dunleavy, Dexter, & Heincke, 2007); the failure to maximize the learning experience for all students, including those with disabilities; and inconsistency in instructional policies and practice (Ertmer, 2005). By determining the reasons why teachers abandon assistive technologies, a set of prevention and intervention strategies may be designed that can help insure that children who could benefit from these technologies will have them available. Such strategies might also help to protect the school's investment in assistive technologies.

The main goal of this study was to determine the rate of assistive technology abandonment among a sample of teachers who used assistive technologies in their classrooms and to identify the reasons cited for assistive technology abandonment. In addition, the study sought to determine the attitudes of the teachers toward assistive technologies and their perceptions of the challenges of using assistive technologies in the classroom. A dual quantitative and qualitative methodology was used to examine the views of a sample of K-12 teachers who used assistive technologies in schools in Georgia. Based on the findings, the research developed several recommendations for professional practice that might help reduce barriers to assistive technology use and improve the persistence rate of assistive technologies in school classrooms.

Research Questions

Five research questions guided the study:

(1) Why do teachers adopt assistive technologies initially? Hu, Clark, and Ma (2003) argued that the motivations that prompt teachers to adopt technologies also provide insight into the reasons why teachers might abandon those technologies in the future.

(2) What are teachers' attitudes and perceptions about the value of assistive technologies? Russell, Bebell, O'Dwyer, and O'Connor (2003) have asserted that attitudes and perceptions of technology decision-makers strongly influence the persistence of use.

(3) What are the challenges that teachers have experienced in adopting and implementing assistive technologies? According to Smarkola (2008), the degree to which teachers find it difficult to adopt and implement a technology, the degree to which technical and operational support is available, and the degree to which teachers perceive technologies to be useful all influence continued technology use and especially utilization of assistive technology.

(4) Have teachers discontinued or decreased the use of assistive technologies in their classrooms? The abandonment rate has been reported as being at least 29% (Phillips & Zhao, 1993), but it may be as high as 75-80% (Ebner, 2004; Verza et al., 2006).

(5) What are the factors that lead to decreased or discontinued use of assistive technology? Identified factors include lack of knowledge, resistance, lack of available resources, and lack of time (Temple, 2006); technology improperly matched to the needs of the individual, lack of appropriate training, and lack of acceptance by families or schools (Ebner); and lack of outside support (Lee & Vega, 2005).

Relevance and Significance

Federal laws stipulate that assistive technologies be made available in the country's classrooms (Osborne, 2004; the Georgia Project for Assistive Technology, 2003). In addition, other stakeholder groups, including researchers, contend that assistive technologies improve students' academic performance. The abandonment of assistive technologies thus poses numerous problems. First, the discontinuation of technologies purchased and not implemented by the school represents a waste of a school's or district's limited financial resources (Meeks, 2007). Assistive technologies are often expensive investments. A school that does not perform maintenance or allows devices to go unused diverts precious resources away from other needs (Meeks, 2007). The abandonment of assistive technologies also poses legal problems (Day & Huefner, 2003). As parents and advocacy groups have become aware that schools are now required to provide assistive technologies, a teacher's decision to discontinue the use of these technologies in his or her classroom may present the threat of litigation to the school. Litigation is also costly and creates challenges for already overburdened human and financial resources (Day & Huefner, 2003). The abandonment of technologies after their adoption also sends mixed messages to students, who have been introduced to the technologies with the message that the devices and software are intended to improve their learning (Ertmer, 2005). When assistive technologies are removed from the classroom, or remain in the classroom but are not used, students lose the opportunities they have been promised. By identifying the barriers to sustained assistive technology use post-adoption and by creating a feasible set of recommendations and corrective measures, the study will

be relevant and significant to the degree it prevents the negative consequences of assistive technology abandonment (Meeks, 2007).

Barriers and Issues

Past research on the subject of technology use by teachers has encountered resistance among study subjects. In their study on technology adoption and subsequent abandonment, Kintsch and DePaula (2002) found that teachers were defensive and avoided disclosing their reasons for technology abandonment. The researchers posited that teachers may have feared some form of recrimination or administrative sanction if they admitted their reasons for abandoning technologies in their classrooms (Kintsch & DePaula, 2002).

This was one potential barrier to the present study. The barrier was addressed by assuring the participants at the outset of the study of total anonymity, explaining the methods that would be used to protect their data, and assuring them that their responses would only be used in aggregate form for purposes of the research.

Another issue faced by this study was how to identify those teachers who use or have used assistive technology in their classrooms in a wide distribution of schools throughout the state of Georgia. To address this issue, the researcher requested the assistance of the technical support specialists in each of the school districts whose superintendents agreed that teachers could take part in the study. Since these individuals worked with teachers involved in using assistive technology in the classroom within schools of their own district, they were best qualified to identify those teachers.

Limitations and Delimitations

One limitation of the study was its sample, which included only K-12 teachers from Georgia who use AT in their classrooms. Since only teachers from Georgia were surveyed, this limited the ability of the findings to be generalized to teachers in other states. The researcher recommends, however, that aspects of the methodology and procedures that were used in the study be replicated by researchers in other states so that a body of knowledge can be developed to understand the phenomenon of technology abandonment in various jurisdictions, each of which is influenced both by federal mandates and by local and state policies and resources.

A second limitation was that several groups that are involved in the use of assistive technology in the classroom were not surveyed. These included administrators, parents, and the children themselves who use the technology. Their perceptions, attitudes, and comments, which might help provide understanding of why assistive technologies are sometimes abandoned, were therefore unavailable.

A third limitation of the study was that of the final sample of teachers who used assistive technology in their classes, over 50% reported their primary grade level as being pre-kindergarten to grade 5, while only 21.3% indicated the middle grades, 6 to 8, and only 16.1% designated high school grades of 9 to 12. Thus, the sample did not evenly represent teachers at all grade levels.

A delimitation of the study was that for the participants who responded only to the study survey, the specific kinds of assistive technologies that they were familiar with was not asked. This information could have helped provide insight into teachers' attitudes and perceptions about the value of and challenges presented by assistive technology. This was

one reason why post-survey interviews were held with some of the participants. These interviews enabled the researcher to delve more deeply into the kinds of assistive technology those participants had used and their perceptions of the value and challenges presented by these technologies.

Definition of Terms

Assistive technology: any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of a child with a disability. The term does not include a medical device that is surgically implanted, or the replacement of such device (Individuals with Disabilities Education Act, PL 102-119 34 CFR 300.5 [U.S. Department of Education, 2004]).

Assistive technology abandonment: any case in which an assistive technology has been implemented within the classroom but discontinued by the teacher, or has been made available in the classroom but not implemented by the teacher. Although there is no accepted standardized definition of the phenomenon of the non-use of assistive technology devices Lauer, Longenecker Rust, and Smith (2006) state that abandonment and discontinuance are synonymous.

Assistive technology coordinator: provides professional learning and technical assistance regarding appropriate assistive technology devices and services for students with disabilities (The Georgia Department of Education, 2008, n.p.). The coordinator is the individual who, in each Georgia school district, acts as a specialized resource person for assistive technology implementations by schools and teachers within the district. The individual helps a teacher understand how to implement and use assistive technologies

and often serves as a troubleshooter when a teacher is faced with a technical problem arising from the use of an assistive technology.

Individualized Education Program (IEP): a written document that is developed for each eligible child with a disability. The content of the IEP includes a statement of the child's present levels of academic achievement and functional performance; a statement of measurable annual goals, including academic and functional goals designed to meet the child's needs that result from the child's disability to enable the child to be involved in and make progress in the general education curriculum and meet each of the child's other educational needs that result from the child's disability; and, for children with disabilities who take alternate assessments aligned to alternate achievement standards (in addition to the annual goals), a description of benchmarks or short-term objectives U.S. Department of Education, 2004).

Section 504: a section of the Rehabilitation Act of 1973 that prohibits discrimination based on disability in programs or activities receiving federal financial assistance. The law prohibits discrimination in access to educational programs and facilities and denial of free appropriate public education for elementary and secondary students (U.S. Department of Education, n.d.).

Chapter Summary

This chapter presented the background, research problem, and goal of the study, and identified the five research questions that guided the investigation. The importance and scope of the research were explained by addressing the relevance and significance, barriers and issues, and limitations and delimitations of the study.

Chapter 2

Review of Literature

This chapter reviews the seminal and recent literature on the subject of assistive technology adoption and subsequent abandonment. The chapter is organized into four sections. The first section focuses on distinguishing assistive technology from the broader area of instructional technology, while the second outlines main reasons spurring assistive technology adoption. The third section of the chapter discusses the challenges presented by assistive technology. The fourth section focuses on the reasons underlying assistive technology abandonment.

Defining Assistive Technology

For purposes of clarification, it is important to establish an operational definition of the term "assistive technology." Assistive technology is any device, software, or teaching strategy that is specifically implemented to help a student with a learning or functional disability to adapt to the learning environment. Instructional technology, by contrast, refers to technologies that are used to facilitate, support, and scaffold the general instruction for all learners. The purpose of the implementation of a technology determines whether it is simply instructional or is considered to be assistive in nature.

This definition of "assistive technology" agrees with the one given in the Individuals with Disabilities Education Act (IDEA) as "any item, piece of equipment, or product system, whether acquired commercially off-the-shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of individuals

with disabilities" (U.S. Department of Education, 2004, n.p.). King-Sears and Evmenova (2007) restate the 1997 IDEA definition of assistive technology as technology that is necessary "to increase, maintain, or improve the functional capabilities of students with disabilities."

One of the confounds of understanding what constitutes assistive technology is that many instructional technologies that are utilized for nondisabled students in general education classes are the same technologies that are considered to be assistive when used by disabled students. This frequently leads to confusion, especially with state testing guidelines. Poel (2007) points out that assistive technology encompasses a broad range of devices from pencil grips to very elaborate communication systems. The confusion is caused when no distinction is made between instructional technology and assistive technology. The Georgia Project for Assistive Technology (2003) points out that this ambiguity gives educational teams the flexibility that they need to make decisions regarding appropriate technology for individual students under the umbrella of assistive technology. Off-the-shelf software, a standard word processor, a CD player, or an iPod might be considered assistive technology if it is used to assist students with disabilities. For example, a word processor may be used by a regular education student who chooses to complete an assignment by typing rather than writing by hand; however, for a student with the disability of dysgraphia, an inability to write legibly, the word processor may not be an option but rather a requirement to accommodate for his or her disability. Forgrave (2002) adds that mainstream computer programs such as word processors also help to support students with learning disabilities through using spell checkers and grammar checkers.

Assistive technology includes a wide range of devices and software programs with an equally broad number of applications. For students with visual deficits, an assistive technology device can enlarge written text or allow text to be read aloud using a computer (Smith & Kelley, 2007). For students who have a physical condition that may prevent them from writing, voice translation programs can convert their speech to text using a microphone, a computer, and a software program (Stodden & Roberts, 2005). These are just a few of the examples of the kinds of assistive technologies that can be used by students with special needs.

The National Assistive Technology Research Institute (NATRI) expounded further on the concept of *function* within the definition of assistive technology in the Individuals with Disabilities Education Act (Blackhurst, 2001). It pointed out that function relates to the action taken to respond to a demand or need. The National Assistive Technology Research Institute has grouped human functions into seven categories to better facilitate a structure for assistive technology services. These categories are as follow:

(a) Existence – functions required to maintain life. This category includes feeding, toileting, bathing, dressing, grooming, and sleeping. Students whose educational programs address these skills are generally those with severe disabilities who are offered a functional curriculum rather than an academic curriculum, or students at the preschool level. NATRI pointed out that services for these students are often provided by an occupational therapist or physical therapist. Examples of assistive technologies for this category are button hooks, adapted eating utensils, and adapted self-care equipment.

(b) Communication – functions involving oral and written expression, visual and auditory reception, internal processing of information, and social interaction. Examples of assistive technologies for this category are electronic communication devices, standard and portable electronic word processors, hearing aids, and alternative assignment formats that employ the use of graphical symbols. NATRI pointed out that services from practitioners such as a speech-language pathologist or an audiologist might be appropriate to support communication functions.

(c) Body Support, Protection, and Positioning – functions that involve maintaining a stable position or support portions for the body. These services are generally directed through an occupational therapist or physical therapist. Assistive technologies that would be used for this category include braces, harnesses, slings, and protective headgear. Because this is a category that requires medical direction, there is also a medical doctor involved in prescribing these devices.

(d) Travel and Mobility – functions such as crawling, walking, using stairs, lateral and vertical transfers, and navigating in the environment. Assistive technologies that address this category include wheelchairs, lifts, canes, walkers, and crutches. As with the previous category, this category requires medical direction from a medical doctor and usually a physical therapist.

(e) Environmental Interaction – functions adapting the individual to the environment or the environment to the individual. Environmental adaptations might address food preparation, operation of appliances, access to facilities, and alteration of the work or living space. Assistive technologies that address this category include adapted door

knobs; environmental control switches for computers, televisions, or other devices; adapted desks to accommodate wheelchair use; and ramps to accommodate wheelchairs.

(f) Education and Transition – skills specifically needed for school activities, therapies, and rehabilitation processes such as assessment, special education instruction, and transition. The scope of providers for this category includes not only teachers but psychologists, rehabilitation counselors, and therapists. Specific assistive technologies include computer-aided instruction, audio tapes, organizers, graphical organizers, and other materials that can help scaffold the work process.

(g) Sports, Fitness, and Recreation – in this functional category, NATRI clustered group and individual play, sports, games, hobbies, and leisure time. Appropriate assistive technologies include adapted materials such as sports equipment with an auditory component for hearing-impaired students, Braille playing cards for students who are blind, and adapted wheelchairs for sports play for those students who require the use of wheelchairs. According to NATRI, coordination with an adaptive physical education teacher is beneficial for assisting such students.

The Impetus to Assistive Technology Adoption

The National Assistive Technology Research Institute pointed out that Section 504 of the Rehabilitation Act of 1973, which is likened to the Civil Rights Act of 1964, legislates against discrimination aimed at those with disabilities (Blackhurst, 2001). It was this law that evolved into laws that specifically address the support of technology for children and adults. Public Law 100-407, also known as the Technology-Related Assistance for Individuals with Disabilities Act, was passed in 1988 and later amended in 1994. This law requires all states to provide a system of assistive technology services to

all individuals with disabilities. Specifically, NATRI held that the purpose of this law is to provide needs assessments, develop a system of assistive technology resources, provide assistive technology services, and provide for public awareness programs.

It was these foundation pieces of legislation that provided the scaffold for the more recent legislation specifically addressing the educational system. Legislation that has been introduced over the past eight years is the primary factor that has influenced the introduction of assistive technologies into American classrooms (Cech, 2008). The No Child Left behind Act and IDEA are the two most important pieces of educational policy and practice legislation that have included provisions for populating classrooms with assistive technology devices and programs (Roach & Frank, 2007). The significance of these two acts is that they mandate reducing the achievement gap between higher and lower achieving students, and between disabled and nondisabled students in particular, by implementing assistive technologies as adjuncts to traditional curricular and pedagogical strategies. In order for schools to qualify for federal funding, they now must demonstrate that assistive technologies are in place and that students in need can access and use them. The Individuals with Disabilities Education Act compels schools to assess the needs of their disabled students and provide them with special services and technologies that are intended to improve their academic opportunities (Apling & Jones, 2007).

Edyburn (2003) pointed out that although educational funding is being reduced, school systems and districts have increased budget allotments for assistive technology. Edyburn also noted that the success of assistive technology is contingent not only on access to the required equipment, but support for its use. One of these supports consists of an increase in the disciplines of service providers within schools to include not only

assistive technologists, but occupational therapists, speech therapists, and physical therapists (Poel, 2007). Each of these groups of professionals now prescribes and implements assistive technology as a part of their service delivery in every school. State and federal funding are contingent upon schools proving that they have assistive technologies available for students. The same government agencies do not require proof of assistive technology use (Apling & Jones, 2007).

Beyond the federal regulations that stipulate the adoption of AT, many teachers recognize the value of assistive technologies in the classroom setting. One benefit of such technology is that the teacher does not, as in the past, have to confront the problem of how to apportion his or her time fairly to assist all students. Instead, the student has a device that assists with some of the functions of teaching (King-Sears & Evemenova, 2007). An example of such a technology is presented by Forgrave (2002), who mentioned the use of speech synthesis in the classroom to facilitate reading for students who have certain learning disabilities. Some students have word decoding (sound-symbol connections) or word recognition skills problems. Speech synthesis technology reads the text that is on the screen and translates it into auditory form. The reading can be accomplished word by word, or by sentence, paragraph, or the entire document. In addition, if the assistive technology program provides highlighting to the text as it is read, additional reinforcement for learning the words is provided. Graphical software such as *Inspiration* can provide organizational scaffolding to the writing process for students. Students use this visual concept mapping software to organize their thoughts and then convert them to a text format. In some instances, depending on the severity of the disability, teachers will accept the graphical document as the final assignment format.

These and other assistive technologies provide better time management for the teacher, while allowing the disabled student to become an independent producer in the classroom and to experience success. Another benefit for teachers is that many assistive technologies provide data collection functions for the teacher. These functions provide real time storage and transfer of data, including grades, attendance, and behavioral observations, which streamlines the teacher's work and makes organization and record-keeping more efficient. In addition to federal mandates and the quest for methods to improve instruction, teachers adopt assistive technology in the classroom because of the pressure exerted by other interested stakeholders (Miller, Adsit, & Miller, 2005). Colleges and employers believe that computers and other technologies facilitate learning and prepare students, even in elementary grades, for the demands of future learning and employment (Gupta, 2008). It is also widely held, both by the public and by researchers, that assistive technologies offer unprecedented opportunities for students and benefit teachers (Stodden, Roberts, Picklesimer, Jackson, & Chuan, 2006). In addition, parents are influencing assistive technology adoption in classrooms (McGee & Diaz, 2007). As more parents learn about the legislation that requires classrooms to become equipped with assistive technology devices and programs, they are using their influence to demand that schools provide their children with current technologies (Cuban et al., 2001; Ferguson, 2008). Parents may, in fact, increase their demands upon schools and teachers because they feel that the school can provide their children with opportunities, devices, and instruction that they themselves may be unable to provide (Jeffs, Behrmann, & Bannan Ritland, 2006).

Challenges of Assistive Technology

Despite the opportunities offered by assistive technologies for students and teachers, there are considerable challenges experienced during the adoption, implementation, and acceptance phases of technology use in classrooms. According to Zhao, Pugh, Sheldon, and Byers (2002), the introduction and implementation stage of technology adoption is "complex and messy" (p. 482). Edyburn (2003) stated that support factors for assistive technology must be provided. These factors include evaluation, selecting and purchase or acquisition, and design or customizing the technology. The final component that is equally important in the process is ongoing training of and technical assistance to the student, teacher, and family. While school systems can fund assistive technology devices and equipment, the funding for the human factor to support the assistive technology is also an important aspect (Lahm, Bausch, & Hasselbring, 2001).

A list of Quality Indicators in Assistive Technology (QIAT) developed by the National Assistive Technology Research Institute established that support by professionals is of paramount importance when implementing assistive technology (Blackhurst, 2001). The list covers eight areas, all of which dictate an intensive involvement by staff. According to the list of quality indicators, the consideration of assistive technology needs should include a team of professionals that have the knowledge and skills to determine the correct assistive technology solutions to address the needs of the student. The needs of the student include not only his or her abilities, but consideration of the environment and acculturation. Decisions for assistive technology should be based on data collection of the student's abilities and specific breakdowns

within the learning process, the learning style of the child, the environment where the child will use the assistive technology, the Individualized Education Program (IEP) learning goals and objectives, curricular and extracurricular activities, and the level of acceptance of the technology.

Forgrave (2002) pointed out that effective assistive technology use and implementation require planning and design, and often students require multiple assistive technologies to address different areas of their academics. It is equally important that assistive technology use be re-evaluated on a continuous basis to adjust for changes in abilities or curriculum needs. Ongoing re-evaluation of the selected technology is imperative. Phillips and Zhao (1993) noted that changes in the user's needs or preferences that made the device either unnecessary or undesirable were a barrier to sustained device use; however, often only a minor reconfiguration of the technology is needed to avoid abandonment of the technology completely.

The use of assistive technology alone will not produce improvement. Human support is crucial; however, it is often not present in the initial assistive technology implementation process. Teachers, who are likely to be managing their own feelings about technology adoption, are responsible for implementing technologies and ensuring their efficacy, and for acclimating and acculturating students to the appropriate use and care of the hardware and software (Carbone, Mannila, & Fitzgerald, 2007). This is a complex task, thus some teachers may be predisposed to abandon the technology well before it has even had the chance to be implemented completely or piloted appropriately in the classroom. In schools that are acutely underfunded or poorly staffed, teachers may also be responsible for actual installation of the assistive technologies, and may have little

or no technical support throughout the adoption and implementation phase ("Cutting-edge," 2008).

Teachers' perceptions, attitudes, and felt pressures to adopt assistive technologies largely determine the degree to which the technologies will be implemented and used in their classrooms, and, ultimately, whether the technologies are likely to be abandoned. The degree to which a teacher believes that technology will be easy to use and will be useful for achieving classroom objectives predicts the trajectory of use in the classroom (Ma, Andersson, & Streith, 2005). Some teachers are excited about the application of assistive technology in the classroom, while others are resistant or even fearful (Lim & Chan, 2007). Resistance and fear are typically responses that can be traced to the teacher's lack of experience or skills in using the technology correctly and for the intended purpose (Smarkola, 2008), and are responses to a lack of self-confidence and perceived self-efficacy. Liaw, Huang, and Chen (2007) reported that while teacher participants in their study were generally enthusiastic about the idea of integrating computer technologies in their classrooms, their enthusiasm was mitigated by perceptions of perceived efficacy of the device and their own competency and efficacy in using the device. In an earlier study, Russell, Bebell, O'Dwyer, and O'Connor (2003) reported that even teachers who have been in the profession for a long time underestimate their technological abilities. It is thus important for teachers to perceive that a technological device or software program will be easy to learn, and then easy to use.

Teachers' perceptions about the ease of use of assistive technologies are shaped by the messages they receive from their administrators. Ma et al. (2005) reported that teachers are more open to and positive about the adoption of technology when

administrators convey the message that they are confident in teachers' abilities to apply technology appropriately in their classrooms, a finding that was affirmed in a more recent analysis by Smarkola (2008). The school's culture may influence the adoption of classroom assistive technologies, the persistence of use, and decisions about whether to retain or abandon the technology. For this reason, administrators must consider the role that they play in assistive technology abandonment, and how they may prevent it by providing tangible support to teachers to make the technology easier to use. Smarkola recommended that administrators assess how teachers feel about technology, even when the adoption of technology is mandated. Ultimately, teachers' initial adoption of assistive technology will not be determined by their beliefs about ease of use and utility, given that federal mandates and the expectations of stakeholder groups demand that such technologies be integrated in classrooms. The rate of assistive technology persistence is likely, however, to be profoundly influenced by these beliefs, and administrators need to be attentive to these variables to prevent technology abandonment and its negative implications. Teachers who feel anxious or fearful are likely to feel that technology will be difficult to use.

According to Baek, Jung, and Kim (2008), Teachers' beliefs about the utility of assistive technologies also influence adoption and persistence of use. These researchers' findings reaffirm earlier research on the subject of the influence of teachers' beliefs and perceptions vis-à-vis continued technology use. In 2003, Hu, Clark, and Ma indicated that "teachers appear to consider a rich set of factors in initial acceptance [of technology] but concentrate on fundamental determinants (e.g. perceived usefulness and perceived ease of use) in their continued acceptance" (p. 227).

Lack of time is another factor that has been identified by teachers as a barrier to assistive technology implementation (Temple, 2006). This factor encompasses the time required to learn the technology and the time involved for training of other staff. Other variables of related concern are the time requirements to create the instructional materials, implement the technology, and collaborate. According to Temple, teachers in urban areas identified this as a problem less than those in rural areas.

Temple (2006) noted that lack of available resources is also a barrier to assistive technology adoption. She made a distinction between a lack of funding and lack of materials and equipment. In her studies, 24% of teachers indicated lack of funding while 21% listed lack of equipment and materials as an issue. Temple summarized several studies that pointed out that funding fluctuations from year to year, new developments in assistive technology, and parents' increased demands are factors that influence the funding facet of assistive technology. In these studies, the type and size of the school district affected whether funding was an issue. Teachers from 22% of the urban school districts and 28% of rural school districts reported lack of funding as a problem. Interestingly, Temple stated that there was not a significant difference in responses from urban and rural school districts in regard to lack of equipment and materials.

Assistive Technology Abandonment

The following operational definition of assistive technology abandonment is used in this research: any case in which an assistive technology has been implemented within the classroom but discontinued by the teacher, or has been made available in the classroom but not implemented by the teacher.

Temple (2006) stated that in her research, 46% of the teachers indicated that assistive technology discontinuance was not a problem. This finding is in contrast to research that has indicated that the current abandonment rate may be as high as 75–80% (Ebner, 2004; Verza et al., 2006).

One reason a teacher might abandon an assistive technology is that the student for whom the technology is intended rejects it. In one of the early seminal studies on the subject of assistive technology abandonment, Phillips and Zhao (1993) studied a population of 227 adults with varying physical disabilities to determine the rate of device abandonment. A secondary goal of their study was to determine what motivates people with a disability to either accept or reject a device. The study is important and remains relevant for a number of reasons. First, the study was longitudinal in nature, so the researchers were able to study patterns of device use from the moment of device acquisition, through the phase of adoption and acclimation, and finally to the moment when the individual chose to retain or reject the device.

Second, the researchers reported that more than one-quarter of all study participants abandoned their device; furthermore, they were able to substantiate, with empirical evidence, that risk of abandonment was highest during the first and fifth years of use. The researchers did not offer an interpretation for those findings. The critical question raised by their study is the significance of the first and fifth year with relation to assistive technology abandonment.

Third, the Phillips and Zhao (1993) study provided insight into some reasons why people may abandon assistive technology devices, as three main barriers to long-term device commitment were identified. The first barrier to device commitment was that the

device had been given to an individual who had little or no input into the process of identifying the need for the device and discussing what sort of devices were available to perform the same function. The second barrier to device commitment was difficulty of acquiring the device, either because of finances or availability. The third barrier to device commitment was poor performance—perceived or actual—of the device.

A more recent study, conducted by Ebner (2004), is phenomenological in nature, based on qualitative techniques of observation and application of information from the literature. Despite methodological limitations, Ebner's study was important because it picked up where the research of Philips and Zhao (1993) left off, focusing on the question, "Why are assistive technology devices abandoned?" Ebner proposed reasons that expand upon the findings of Phillips and Zhao, and the reasons offered are especially relevant for a study of assistive technology abandonment within educational settings. One of the reasons found by Ebner for assistive technology device abandonment is that the technology selected for use has not been matched appropriately to the individual's conditions and needs. This mismatch may be due to stakeholders' lack awareness of what assistive technology is available and how different needs can be addressed with different assistive technologies, as was found by Temple (2006).

This lack of breadth of knowledge of assistive technology can cause problems from the onset of device use, and often triggers other reasons for abandoning the device. For the K-12 population, although Public Law 105-17 mandates that assistive technology be considered in the IEP, consideration is often a formality rather than a thorough process. P. Reed (1999) pointed out that consideration of assistive technology should include discussion and examination of all of the options by all stakeholders in the

meeting to develop the IEP, and should not be an incidental treatment of the assistive technology needs specified in the plan. Assistive technology services in the K-12 school system include the educational team that is comprised of the teacher, the school administration, and the parents. The team has available occupational and physical therapists in addition to assistive technology specialists and engineers who provide intensive evaluations and help make recommendations individualized to the specific student's needs.

B. J. Reed (1995) pointed out that most often the medical model of delivery is used to make decisions about use of assistive technology in specified cases. In this model, the student, teachers, and parents are told which assistive technology is appropriate. In contrast, the consumer model provides for the student, parents, and teachers to participate in the decision of what technology is most appropriate and should be utilized. The latter model provides motivation and attributes responsibility for success to those with a vested interest.

The consumer model is supported by Rotter (2006), who developed the theory of locus of control of reinforcement. This theory postulates that people respond to their environment based on their perception of how much control they have over events or circumstances. Locus of control is likely an acceptance factor for the teacher, the student, the parents, and even the administration. If these stakeholders are a part of the decisions and have a conclusive sense of the efficiency of the assistive technology, they are motivated for the success of the assistive technology. Motivation is a primary factor in acceptance of assistive technology. In addition, each member of the team and ultimately

the user selects and adopts assistive technology based on the perception of that which is most efficient (Johnston, 2005).

Another problem that precipitates device abandonment is the absence or inadequacy of orientation and training provided to the user (Ebner, 2004). Temple (2006) found that teachers want training on how to use AT and how to integrate it into the learning environment, and held that access to training and consultation is important for the success of assistive technology. Temple emphasized that training not only the teacher but also the staff is important. Students are generally served by many different staff and in different environments throughout the school. These staff members should be trained in how to customize the assistive technology in each of these environments. Temple also stated that the training component may correlate with diminishing teacher resistance, and that teachers expressed satisfaction with group training. Temple pointed out that in her research, resistance was a barrier in all types of school districts with approximately the same statistical significance, and that the type of school district does not appear to influence resistance. Individual training in the teacher's classroom can provide a functional implementation for the teacher within his or her unique environment.

In related research, Zhao and Cziko (2001) stated that the following three elements are required for technology use. These factors can also be applied to the use of assistive technology.

1. The teacher must believe that technology can more effectively achieve or maintain a higher-level goal than what has been used,

2. The teacher must believe that using technology will not cause disturbances to

other higher-level goals that he or she thinks are more important than the one

being maintained, and

3. The teacher must believe that he or she will have the ability and resources to

use the technology.

Another reason assistive devices are abandoned is because other stakeholders in

the user's life are not acclimated to the device, nor is it considered how the device might

affect them (Ebner, 2004). In order for certain kinds of assistive technology devices (e.g.,

communication devices and mobility items) to be adopted in the educational setting, they

need to be used in other environments such as the home and recreation so that the users

and their families get accustomed to using the technology. Lee and Vega (2005) found

that lack of outside support was a primary barrier to adoption of assistive technology.

Their research emphasized that the more assistive technology training for the

stakeholders, including the family and others who are a part of the user's life, the higher

the importance of the assistive technology to the individual and the greater its subsequent

use.

Temple (2006) found that access not only to equipment and materials but support

was identified as a significant concern by teachers in the educational setting. Not only

should the initial process of evaluating the student, which is driven by the IEP process, be

accomplished quickly, but the placement of equipment in the classroom for the child,

training, and follow-up support should also be accomplished in a timely way. Equally

important to access and acquisition of the assistive technology is the timeliness of the

service component. Service includes the initial setup and training for the use of the

assistive technology and the ongoing response to request for support. Each of the components of the process is crucial to the success and adoption of the assistive technology.

The perceived utility and ease of use of assistive technology often determine whether it will be continued over time. For some devices, transportability and social acceptability can be problematic. This is especially true of communication devices for students who have serious speech impediments or are unable to speak at all. In order for these communication devices to be used with the optimum success, they must be used consistently throughout the day in each environment in which the child participates. Consistency is important because learning occurs best in the natural setting of customary activity, and the technology must be infused fully and transparently into the child's daily life to be fully accepted. Such communication devices are frequently large, bulky, and cumbersome to transport, however, and if the technology cannot be transported easily from one setting to another, not only physically, but also socially, it is likely to be abandoned (Ebner, 2004).

Chapter Summary

This chapter presented a review of literature relevant to the research. Following a brief overview, the term "assistive technology" was defined. Types of assistive technology were characterized in terms of the various purposes for which these technologies are used by students.

Several important factors that spur assistive technology adoption were identified, including federal legislation, teachers, and the parents of children with disabilities. Challenges presented by assistive technology were then discussed, especially challenges

that teachers face in implementing the technologies in the classroom. A number of

reasons why the use of assistive technologies in the classroom is sometimes reduced or

abandoned were also discussed.

Chapter 3

Methodology

Study Design

This was a mixed quantitative and qualitative study intended to provide information to help understand why K-12 teachers decrease or discontinue the use of assistive technology in the classroom. To pursue this objective, the researcher developed two instruments. The first was a questionnaire that was distributed to a sample of K-12 educators in the state of Georgia who use assistive technologies in their classroom. The purpose of the questionnaire was to capture the teachers' beliefs, attitudes, and perceptions that influence their adoption and continued use of assistive technologies in their classrooms. The second instrument was an interview guideline consisting of several open-ended questions.

The following research questions were addressed by the study:

1. Why do teachers adopt assistive technologies initially?

2. What are teachers' attitudes about the value of assistive technologies?

3. What challenges have teachers experienced in adopting and implementing assistive technologies?

4. Have teachers discontinued or decreased the use of assistive technologies in their classrooms?

5. What are the factors that lead to decreased or discontinued use of assistive technology?

Procedures

The first step in the study was an extensive review of the current literature on the subject of assistive technology adoption and abandonment by teachers. Examination of the literature resulted in the identification of five constructs to be measured, one for each of the research questions identified in the previous section:

1. the participant's reasons for adopting assistive technology;

2. the participant's attitudes toward the value of assistive technology for students;

3. the participant's perceived challenges presented by assistive technology;

4. whether use of assistive technology has been decreased or discontinued in the participant's classroom; and

5. if assistive technology has decreased or been discontinued in the participant's classroom, factors leading to this development.

The second step was to prepare and submit an application for human subject research for the Nova Southeastern University Institutional Review Board's (IRB) approval. The study closely adhered to the requirements for human subject research. Participants in the study were assured of their total anonymity. The methods that were used to protect their data were explained to them. They were assured that their responses would only be used in aggregate form for purposes of the research, and that no personal identification of them would be made. When IRB approval was granted (see Appendix A), the study continued on to the next step.

The third step in the procedure was to develop and validate a survey instrument to be used to gather the views of the study participants, and an interview guide for the qualitative part of the study. For detailed information on the instrument and the interview guide, see "Instrumentation."

The fourth step involved constituting a sample of educators to take part in the study. This sample consisted of K-12 teachers who used assistive technologies in the classroom and who were from schools in the state of Georgia. The sample was chosen according to the following three-step procedure.

1) A letter was e-mailed to the superintendents of all 189 Georgia school districts asking their permission to conduct the study by recruiting teachers in their districts (see Appendix B), and a follow-up letter was e-mailed approximately one week later to those that had not replied to the first letter. Those who approved of the study would comprise the districts from which schools assistive technology coordinators for the districts would be contacted (see 2 below).

2) The assistive technology coordinator of each school district for which the district superintendents gave approval that teachers in the district could take part in the study was contacted by e-mail, provided information about the study, and asked to assist with the study by informing teachers who used AT in schools in that district of the study (see Appendix E). Follow-up e-mails were sent as necessary.

3) Each of the assistive technology coordinators contacted all of the teachers who used or had used assistive technology in the schools in their school district. The contact was via an e-mail that was furnished by the researcher to each assistive technology coordinator (see Appendix F). The e-mail explained the nature of the study to each of the

teachers, assured them of anonymity, and provided them with the website address to complete the survey.

The fifth step of the procedure consisted of placing the survey questionnaire on the researcher's website located at http://www.techknowland.com. Preceding the survey form was a brief explanation of how to fill out and submit the form, a guarantee of anonymity, and a statement that the subject's completing the survey indicated his or her voluntary consent to participate in the research. At the end of the questionnaire, participants were asked if they were willing to participate in a 15-minute telephone interview later in the study and if so to enter their e-mail address in the box provided. They were told that if they did so, their e-mail address would be transferred into a randomized file that would not be associated in any way with their responses to the survey questions, that the researcher would use their e-mail address only to contact them about a possible telephone interview, that their e-mail address would be held strictly confidential, and that their anonymity would be assured in any future interview participation. Upon a participant's completion of the online questionnaire, his or responses were sent to the researcher's e-mail address for tabulation and analysis. All submitted e-mail addresses went to a different file that was sent to the researcher's e-mail address.

To help insure that steps four and five would take place as intended, a pilot study was conducted. In the pilot study, 12 K-12 schools were randomly chosen from all schools in the state of Georgia, and the assistive technology coordinators for the districts in which the schools were located were contacted to ask them to contact teachers in their schools who used AT in their classrooms. The online survey form was placed at a

different web address on the http://www.techknowland.com website than it was for the actual study. The purpose of the pilot study was to detect any problems in locating participants or in setting up, administering, or collecting the survey form responses so that any such problems could be addressed for the main study.

A preliminary confirmatory factor analysis was conducted on the results of the submitted surveys in the pilot study. The purpose of confirmatory factor analysis is to understand how a set of observed variables relates to a set of continuous latent variables, or factors. In this case, the observed variables were participants' responses to Likert-scaled items in sections two and three of the questionnaire. The latent variables were the factors that accounted for covariance among the observed variables (Albright, 2007; Muthén & Muthén, 2007). Responses to questionnaire items in sections two and three were analyzed to determine whether the number of factors in each set of questions agreed with the number of hypothesized factors.

The sixth step of the process was to review and analyze the responses of teachers to the online surveys. The returned surveys were first examined for completion of all sections. Next, the data were compiled and analyzed (see "Statistical Analysis" below). The analyzed data were organized into a clear and presentable data set used to determine the findings.

While the quantitative data were being analyzed, the seventh step began. This step consisted first of identifying 10 of the surveyed teachers who were willing to engage in a 15-minute telephone interview addressing several open-ended questions. As explained above, all participants who completed the questionnaire were asked to submit their e-mail addresses if they were willing to be interviewed. Ten teachers were randomly selected

from those who agreed to be interviewed. These individuals were contacted and an interview time was arranged. The telephone interviews were audio recorded with the interviewees' knowledge and permission. The audio recordings were transcribed by the researcher and analyzed using the method described below ("Analysis"). Based on both the quantitative and qualitative findings, each of the five research questions were addressed and answered.

The purpose of interviewing 10 members of the sample was to understand, in greater detail, teachers' attitudes toward assistive technology, the challenges they face in adopting assistive technology, and their reasons for adopting and abandoning assistive technology. The survey instrument did not delve into issues such as the types of assistive technology the teachers used and how their attitudes might vary depending on their experience with different types of assistive technologies. It also did not ask teachers for details about their perceptions of issues such as time constraints and implementing assistive technology in the classroom. It was deemed that such issues could be better addressed in an interview. To create maximum value for the interviews, the open-ended questions were not determined until the results of the survey had been analyzed. This enabled the interview questions to be formulated so that they could provide clarifications of survey results or address discrepancies that might arise. An interview guide was developed and used by the researcher to ensure that all interviewees were asked the same questions (see Appendix H.)

The researcher concluded the study by developing a list of recommendations for practice, the purpose of which were to provide guidance for school administrators and teachers with respect to improving assistive technology adoption, implementation,

maintenance, and support processes so that attrition and abandonment of assistive technology can be reduced. The recommendations were made on the basis of the findings of the study, including the participants' attitudes and perceived challenges in implementing assistive technology; how many educators had increased, decreased, or abandoned their use of assistive technology in their classes; and, for those who had decreased or abandoned assistive technology, the factors involved in their doing so.

Instrumentation

The researcher developed a questionnaire and an interview guide for this study. Although previous research has been conducted on assistive technology abandonment, no research was identified that specifically examined teachers' decisions to persist with assistive technology or to abandon it; therefore, no appropriate questionnaire or interview guide existed that could be used in the context of this study.

The researcher-developed questionnaire included an initial section to collect demographic data about the participants. Each of the following five sections corresponded to one of the five research questions. The first section asked participants to check off any of a provided list of reasons that they had for adopting assistive technology and to write in any additional reasons. The responses to this item were used to answer the first research question. The second and third sections each consisted of several items, using a five-point Likert scale, asking participants about their attitudes toward assistive technology and the challenges they faced in using assistive technology, respectively. Responses to these items were used to answer research questions two and three. The fourth section consisted of two yes-no questions relating to whether participants had recently decreased or discontinued the use of assistive technologies in their classrooms.

Replies to these questions were used to answer research question four. The fifth section asked those participants who had recently decreased or discontinued the use of assistive technologies in their classrooms to indicate their reasons for their making that decision. The responses to this item were then used to answer research question five. (See Appendix G.)

The content and construct validity of the questionnaire was established by asking a panel of three experts in the use of assistive technology for education and training to review the instrument (see Appendixes C and D). The panel of experts that was approached to perform this function consisted of an official at the state level of the Georgia Project of Assistive Technology who trains teachers in the use of assistive technology, an expert in the private sphere who trains Georgia K-12 teachers in the use of assistive technology, and an instructor at the collegiate level whose dissertation was about assistive technology and who is also a director and instructor of assistive technology at the county level.

The experts were asked to review the questionnaire to determine (a) whether the questions and other items were phrased correctly, and were clear and easily understandable; (b) whether the items were correctly focused on the constructs to be examined; and (c) whether additional questions should be included. Members of the expert panel made several recommendations, and the instrument was revised based on these comments.

The second step in validation of the instrument was to test it for internal reliability. In this case, internal reliability refers to internal consistency, which is the degree to which a set of items that are meant to measure the same construct actually do

measure that construct (Henson, 2001). For the questionnaire in this study, a measure of internal consistency was appropriate for the items in section two concerning attitudes, and section three concerning challenges since these two sections of the survey instrument, unlike the other sections, consisted of Likert-scaled items that were meant to measure various constructs concerning teachers' attitudes and challenges. A preliminary confirmatory factor analysis was performed on these items in the pilot study to determine if the number of factors represented by items in these two sections agreed with the hypothesized number of factors (Albright, 2007; Muthén & Muthén, 2007). The hypothesized number of factors for the items in section two of the survey was expected to be one—teachers' attitudes toward the value of assistive technologies for students using those technologies. For the items in section three, which concerned challenges that teachers face in relation to assistive technology, the hypothesized number of factors was four: (a) teachers' perceived degree of administrative support for classroom use of assistive technology, (b) teachers' perceived degree of training in the use of assistive technology, (c) teachers' perceived time constraints in using assistive technology in the classroom, and (d) teachers' perceived degree of technical difficulties encountered in implementing assistive technology in the classroom. A final confirmatory factor analysis was conducted on the results of the main study questionnaire to determine the number of factors addressed by the items in sections two and three.

In addition to the questionnaire, an interview guide was developed after results from the survey were analyzed. This guide included several open-ended questions (see Appendix H). To determine the content validity and clarity of this instrument, the expert panel mentioned above was asked to review the questions on the interview guide for

clarity and appropriateness. Feedback from the panel was considered, and the interview guide was revised based on the feedback.

Statistical Analysis

The quantitative data were calculated according to aggregate responses to the items that were included on the survey instrument. Statistical calculations included frequency of responses and the mean response for each item. Because the study was not intended to determine correlations between assistive technology abandonment and other variables, *t*-tests and other statistical analyses were not considered necessary for the purposes of this study. A preliminary confirmatory factor analysis was conducted on survey responses submitted in the pilot study, and a final confirmatory factor analysis was conducted on the survey responses submitted in the main study. These factor analyses focused on responses to sections two and three of the non-demographic part of the survey in order to determine the actual number of constructs that were indicated in participants' responses to the items in sections two and three. For items in sections two and three of the survey, a five-point scale ranging from strongly disagree to strongly agree was used. Scoring of items depended on their wording, with items being reverse scored as necessary to ensure that the scale measured the same relative attitude or perception for groups of items. The SPSS statistical program was used to conduct statistical procedures.

Qualitative methods were used to analyze participants' responses to the open-ended questions in the interviews. Qualitative analysis seeks to uncover categories, patterns, and themes that may emerge out of qualitative data collected in various ways, including interviews (Patton, 1980). Participants' responses to the open-ended questions

were analyzed to determine any themes in their replies. A three-part method suggested by Huberman and Miles (1984) was used to analyze the interview responses. The first two steps of this method consisted of the reduction and the display of the data. The third step consisted of drawing conclusions. In the first step, data reduction, participants' comments were examined to identify their cognitive content. This involved deleting extraneous or repetitive words in their replies. In the second step, data display, the reduced replies for each question were organized on a computer screen and examined for similarities. In the third step, themes in the participants' interview responses were identified. A theme was considered a case in which three or more participants expressed the same concern, explanation, or other comment in their replies to an interview question.

Chapter Summary

This chapter explained the methods that were used in the study. The first section explained the research design. It identified the research questions and explained how these questions were addressed by using both quantitative and qualitative methods. The second section explained the step-by-step procedures used in the research, including selection of schools and participants, the pilot study, the administration of the surveys, and how interviews were conducted.

The third section of the chapter explained the nature of the survey instrument, including how its content and construct validity were determined, and how internal reliability was measured. The fourth section explained how quantitative results were statistically analyzed and explained the qualitative methods used to analyze the interview results.

Chapter 4

Results

This chapter presents the results of the study. The chapter is divided into five main sections. The first section presents the results of the pilot study and explains how the final number of participating school districts for the main study was determined. The second section presents demographic results and the quantitative results of the study based on the participants' replies to the online survey about assistive technology. The third section presents the qualitative results of the study based on the responses of participants to the telephone interview. In the fourth section, the five research questions of the study are answered based on the quantitative and qualitative results. In the final section, a summary of the results is presented.

Results of the Pilot Study and Participation

Results of the pilot study. A pilot study was conducted to ensure that the online survey format would work properly and that responses to Sections 2 and 3 of the online survey, when subjected to factor analysis, would agree with the hypothesized number of constructs for each section. In the pilot study, 12 K-12 schools were randomly chosen from all schools in the state of Georgia, and AT coordinators for the districts in which the schools were located were contacted to ask them to contact teachers in their schools who used AT in their classrooms. Twenty to 40 responses were expected; however, only 18 responses were received.

No problems surfaced in regard to the online survey format. A factor analysis of items in Section 3 showed that each of the four sets of items that were meant to measure participants' perceptions of four challenges had only one factor, which had been hypothesized. However, a factor analysis of the responses to the six items in Section 2 resulted in three components instead of the hypothesized one. Different rotations and variations were tried, but in each case, the analysis showed more than one component, and no interpretation of the results to explain more than one component could be determined. With further investigation, it was found that by deleting responses to Questions 5 and 6, the analysis resulted in only one component. However, the researcher believed that those two items actually did measure the construct of overall attitude of teachers to AT, and the expert panel had approved those questions. Furthermore, it seemed likely that the unexpected results of the analysis were the result of the low number of participants, making the analysis very sensitive to variations in particular participants' responses. Also, there was considerable consistency in responses to the six questions, with Cronbach's alpha = .65. In light of this, it was believed that with a substantially greater number of responses in the main study, factor analysis would show a single component for the items in Section 2. Based on this reasoning, it was decided to go ahead with the six items as they were.

Participation. A total of 28 superintendents of Georgia school districts agreed to take part in the study by allowing teachers who use AT in their districts' schools to be surveyed and interviewed. Assistive technology coordinators for each of these 28 districts were contacted to enlist their assistance to provide information on the study to AT

teachers in their schools and to invite them to be part of the study. A total of 19 AT coordinators agreed to assist in the study.

After being informed by the AT coordinators about the study, the total number of AT teachers who responded to the online survey was 174. Of these, 52 agreed on their online form to be interviewed later by the researcher, and 10 of these were randomly selected to be interviewed.

Demographic Results

The first three items on the online survey provided a partial demographic profile of the participants. Question one asked the teachers which of four categories best described their primary grade level. Of the 174 teachers who responded to this question, 88 (50.6%) designated the elementary grades (pre-kindergarten to grade 5) as their primary grade level, 37 (21.3%) designated the middle grades (6 to 8), 28 (16.1%) designated high school (grades 9 to 12), and 21 (12.1%) designated all grade levels (pre-kindergarten through grade 12).

Question two asked the teachers how many years of experience they had in education. Of the 174 teachers, 27 (15.5%) had less than five years of experience, 40 (23.0%) had five to nine years of experience, 60 (34.5%) had 10 to 20 years of experience, and 47 (27.0%) had more than 20 years of experience.

Question three asked the teachers how much experience they had in using assistive technology in their classes. Of the 174 teachers responding, 67 (38.5%) had less than five years of experience, 53 (30.5%) had five to nine years of experience, 45 (25.9%) had 10 to 20 years of experience, and nine (5.2%) had more than 20 years of experience in using assistive technology.

Quantitative Results

After the demographics section, the remainder of the online survey consisted of four sections. The results for each of the four sections are reported below.

Section 1 results. Section 1 consisted of a single question asking the teachers to state their reasons for adopting assistive technology in their classrooms. The teachers were given a list of six possible reasons for adopting assistive technology and asked to state which ones were reasons for them. Of the 174 teachers, the numbers of teachers that indicated each of the six reasons are shown in Table 1 (some teachers indicated more than one reason).

Table 1

Teachers' Reasons for Adopting Assistive Technology in Their Classrooms

Reason	Number Indicating (%)
1. AT is mandated for at least one student with an Individual Education Plan in my classroom.	104 (59.8%)
2. The use of AT enables students to be able to show what they know.	129 (74.1%)
3. The administration expects or requires me to use AT in my classroom.	28 (16.1%)
4. One or more students have asked to use it.	32 (18.4%)
5. The use of AT is part of teacher evaluation in our school.	14 (8.0%)
6. Parents of one or more students expect the use of AT for their child.	51 (29.3%)

The teachers were also asked to state any other reasons they had for adopting assistive technology for their classrooms. Twenty-six of the 174 participants responded with additional comments. A number of these responses did not actually state reasons other than the ones listed, but rather referred to whether the teacher used AT or the ways in which the teacher used AT. However, 12 of the participants did state reasons other than the ones listed for adopting assistive technology in their classrooms. Their comments were as follows:

- AT gives access to regular ed. curriculum in an alternative/modified format.

- Students are more interested in the content when AT is used.

- AT is required for my students to access the curriculum.

- It is the best way to meet goals and expose my students to grade level standards.

- The use of AT encourages my students' vocabulary. Imitating the words or word.

- It allows children to communicate that otherwise would not be able to do so. It also increases the use of words by those who are verbal and can greatly increase MLU.

- The AT I use allows my students to access the curriculum better. Without it they would have to attend a separate school and learn a separate language.

- AT is a valuable teaching tool & gives students a way to communicate wants & needs.

- AT allows a variety of ways to communicate especially for the non-verbal student. Students enjoy it. Helps make life a little more easier and less frustrating.

- AT makes for much more innovative ways to keep the attention of and get students actively involved with owning their own education.

- Because we have the best assistive technologist….

- It is another means for helping students access the curriculum with success.

Section 2 results. The purpose of Section 2 of the survey was to measure the participants' attitude toward assistive technology. It consisted of six items (Items 5 through 10) using a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). For each of these items, a total of from 171 to 173 teachers responded.

The six items in Section 2 were developed for the purpose of measuring only one construct, which was the teachers' positive or negative attitude toward the value of assistive technology. To determine whether one or more constructs were actually measured by the six items, a reliability analysis and a principal components correlation matrix analysis of the teachers' responses were completed. Prior to conducting these analyses, the three negative items, 5, 7, and 8, were reverse scored so that responses would calibrate with the three positive items.

The reliability analysis resulted in a Cronbach's alpha score of .73, which indicated acceptable agreement among the responses to the six items of section 2. The principal components correlation matrix indicated that the six items measured only one component with eigenvalue greater than 1 (eigenvalue = 2.707). This single component was interpreted as teachers' positive or negative attitude toward the value of assistive technology.

Table 2 presents the mean and standard deviation for the participants' responses to each of the six items that were in section 2, along with the number of teachers responding to each item. These results indicate that the teachers had a mostly positive attitude toward assistive technology. This is shown by the relatively high scores for the

positive statements about assistive technology expressed in items 6, 9, and 10, which had

an overall mean of 4.12, and by the relatively low scores for the somewhat negative

statements about assistive technology expressed in items 5, 7, and 8, which had an overall

mean of 2.21.

Table 2

Mean Responses to Items in Section 2 of Online Survey

Item	*n*	*M (SD)*
Positive statements		
Item 6: Assistive technology is often an effective tool for the student to access the curriculum.	171	4.05 (.94)
Item 9. I have seen students progress because of their use of assistive technology.	173	4.02 (.81)
Item 10. Assistive technology can be valuable for students at any grade level.	173	4.29 (.72)
Negative Statements		
Item 5: The difficulties of implementing assistive technology outweigh its benefits.	173	2.25 (1.13)
Item 7. Use of assistive technology makes students reliant on the tool and negatively affects their skill development.	172	2.07 (.80)
Item 8. The pedagogical value of assistive technology is often over rated.	172	2.30 (.80)

Section 3 results. The purpose of Section 3 of the survey was to measure the participants' perceptions about four different kinds of challenge they may face in using assistive technology: training, time constraints, support, and technical problems. A section consisted of a total of twelve items (items 11 through 22) using a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). There were three items in the section to measure the teachers' perceptions about each of the four kinds of challenge. For each of these items, a total of from 171 to 174 teachers responded.

To determine the internal consistency of the three items for each kind of challenge, a reliability analysis and a principal components correlation matrix analysis of the teachers' responses for each set of three items were completed. The majority of the 12 items were stated in a negative manner, while two of the items, numbers 18 and 21, were stated in a positive manner. These two items were reverse scored so that responses would calibrate with the negative items.

For items 11, 15, and 18, which were intended to measure teachers' perceptions of whether they had adequate training, reliability analysis showed a Cronbach's alpha score of .63. Principal components analysis indicated that the three items measured only one component (eigenvalue = 1.725).

For items 12, 16, and 20, which were intended to measure teachers' perceptions of time as constraint on using assistive technology, the Cronbach's alpha score was .71. Principal components analysis indicated that the three items measured only one component (eigenvalue = 1.916).

For items 13, 17, and 21, which were intended to measure teachers' perceptions of the adequacy of their administrative support for assistive technology, the Cronbach's

alpha score was .60. Principal components analysis indicated that the three items measured only one component (eigenvalue = 1.699).

For items 14, 19, and 22, which were intended to measure teachers' perceptions of the degree of technical problems they faced with assistive technology, the Cronbach's alpha score was .81. Principal components analysis indicated that the three items measured only one component (eigenvalue = 2.164).

The results of these reliability analyses and principal components analyses suggested that the four sets of items on Section 3 of the survey measured what they intended to measure. Furthermore, a reliability analysis of responses to all 12 items was also conducted. This resulted in a Cronbach's alpha score of .83, which indicated acceptable reliability for the items in Section 3 taken all together.

Table 3 shows the number of respondents, as well as the mean and the standard deviation for the responses to each of the 12 items that were included in Section 3 of the online survey. The table also shows the mean result for each item based on interpretations of the Likert scores.

Sections 4 and 5 results. The purpose of Sections 4 and 5 of the online survey was to determine whether participants had decreased or discontinued their use of assistive technology during the 2008-2009 school year and if so, their reasons for doing so. To determine whether there was a decrease or discontinuance, two yes or no questions were asked in Section 4, Items 23 and 24. Table 4 shows the responses to these two items. The table shows the total number of teachers responding to each question, as well as the numbers and percentages responding for each alternative.

Table 3

Mean Responses to Items in Section 3 of Online Survey

Item	n	M (SD)	Mean Result
Perceptions of Adequacy of Training			
Item 11: I need more professional development Opportunities for learning how to use assistive technology effectively.	173	3.99 (0.96)	Agree
Item 15: I do not always understand how to differentiate a lesson by incorporating assistive technology.	173	3.00 (1.08)	Neutral
Item 18: I have adequate training in and knowledge of assistive technology for my classroom needs.	174	3.19 (1.03)	Agree
Perceptions of Time as a Constraint			
Item 12: Assistive technology requires too much time to use.	173	2.43 (0.97)	Disagree
Item 16: By requiring so much extra time, using assistive technology slows the pace of learning for the class.	174	2.54 (0.99)	Disagree
Item 20: Time constraints prevent me from using assistive technology more often.	172	3.21 (1.12)	Agree
Perceptions of Adequacy of Administrative Support			
Item 13: I would use assistive technology more frequently if there was more support to help me with problems that arise.	174	3.57 (1.03)	Agree
Item 17: I need access to more resources (e.g., personnel, premade lessons, technical support) to be able to use the available assistive technology resources effectively as part of my instructional day.	173	3.55 (0.97)	Agree
Item 21: Adequate assistive technology support is available to me.	173	2.74 (1.00)	Disagree

Table 3(continued)

Item	n	M (SD)	Mean Result
Perceptions of Technical Problems			
Item 14: I am sometimes reluctant to use assistive technology because it frequently does not work correctly.	171	2.92 (1.03)	Disagree
Item 19: Recurring technical problems substantially reduce the value of assistive technology in my class.	173	2.96 (1.06)	Disagree
Item 22: Too often, assistive technology does not operate properly.	174	2.95 (1.02)	Disagree

Table 4

Responses to Online Survey Items 23 and 24.

Item	n	Yes (%)	No (%)
Item 23: As the 2008-2009 school year progressed, students' use of assistive technology in my classroom decreased from its use when it was first implemented.	172	57 (33.1%)	115 (66.9%)
Item 24: One or more of the assistive technologies that were implemented for students in my class during the 2008-2009 school year were discontinued during that same school year.	172	52 (30.2%)	120 (69.8%)

In Section 5, participants who answered "yes" to Item 23 or 24 were asked for their reasons for the decrease or discontinuance. The teachers were given a list of 17 possible reasons and were also provided space to write their own reasons. Twenty teachers wrote their own reasons for decreasing or discontinuing use of AT in their classrooms. Table 5 shows the number of teachers marking each of the 17 listed reasons, as well as the number who wrote in answers in each of five different categories.

Qualitative Results

Telephone interviews were held with 10 teachers who had completed the online survey and had agreed to be interviewed. The teachers replied to a question about how many years she or he had used assistive technology, and then to eight open-ended questions, some of which included probe questions. Interview questions had previously been examined by a three-member expert panel, and suggestions made by panel members for revising several questions were followed.

The telephone interviews lasted from about 10 to about 15 minutes. Of the 10 participants, seven were female and three were male. The interviews were audio recorded and later transcribed by the researcher. These transcriptions were then examined carefully and subjected to the three-step procedure explained in Chapter 3: Data Reduction, Data Display, and Theme Identification. Within the responses to the eight open-ended questions, color coding was used to classify comments that expressed similar explanations and ideas among the participants. If three or more teachers expressed the same comment or idea, that comment or idea was considered to be a theme in replies to the question. The following subsections explain the themes that were identified for each

Table 5

Teachers' Reported Reasons for Decreasing or Discontinuing Use of AT

Reason	Number Responding
1. Use of assistive technology makes students reliant on the tool and negatively affects their skill development.	4
2. The AT device(s) was (were) too difficult to transport between classes or learning environments.	11
3. One or more students using the AT no longer needed it.	27
4. One or more students and/or parents rejected the AT.	16
5. AT required too much teacher time.	19
6. AT was not beneficial for the student(s).	10
7. AT accessories were missing and not replaced (e.g., cables to transfer data, manual, batteries).	15
8. One or more AT devices broke and were not repaired.	13
9. One or more students forgot to bring the AT tool to class.	13
10. I needed more training in AT and it was not available.	17
11. The school system could not provide the money to support the technology.	13
12. The student(s) needed more training in AT and it was not available.	13
13. There was not enough instruction time to use AT.	19
14. AT caused a disruption in the classroom.	8
15. Use of AT is not "real life," and the student needs to learn to function without it.	5
16. Not enough staff was available to support the use of AT.	14
17. AT hindered instructional time.	1
Written reasons	
• No students in the class needed AT.	10
• There was insufficient time to use AT.	3
• There were technical and/or repair problems with the AT equipment.	4
• Student rejected device or it was not used sufficiently outside class.	3
• There were insufficient facilities to support AT.	2

of the questions. For each of the open-ended questions, the themes will be identified, along with the number of participants expressing the theme, and an example will be given of statements verbalizing the theme.

Results for Interview Question 1. Question 1 was: How many years have you used assistive technology in your classes? Answers to this question were very brief and ranged from four to over 20 years. Eight of the 10 participants responded by saying that they had used AT in their classes for more than 10 years. This question was not open-ended. The participant was asked simply to state a number of years. Therefore, the replies to this question were not examined for themes.

Results for Interview Questions 2 through 9. Questions 2 through 9 were open-ended questions for which teachers' responses were analyzed to determine themes in their replies. The results for responses to these questions are presented in Table 6. For each interview question, the themes are listed, along with the number of teachers who expressed that theme and an example of a statement that communicated the theme. In addition, for each question, near-themes that were expressed by at least two participants are listed.

It should be noted that in response to Question 2, teachers mentioned a number of specific devices and programs. The kinds of AT items mentioned fell into four main classes, and in the analysis, these classes were considered to be the themes of the teachers' responses.

It should also be noted that there appeared to be some confusion among participants in regard to the meaning of Question 6, "How would you describe the support for assistive technology that you receive from your school?" At least two of the

teachers indicated that they did not receive support from the school but did receive support from the school system. Others appeared to assume that the term "school" meant both the school and the school system. In analyzing the responses, the two kinds of interpretation were combined so that the relevant issue became how satisfied participants were about support by either the school or the school system.

Table 6

Themes for Responses to Interview Questions 2 through 9

Question	Themes and Examples	Number

Q2. What kinds of assistive technology have you used in your classes over the last year?

<u>Four themes</u>

1. Teacher has used stand-alone communication devices over the last year.   8
   Participant 6: "Older devices such as Go Talk, Twin Talkers… Big Macs."

2. Teacher has used computer/software/Internet over the last year.   7
   Participant 3: "… different reading programs that get the children through after they reach a level like Ed Mark."

3. Teacher has used computer peripherals over the last year.   5
   Participant 4: "… touch screen curriculum …, roller mouse, digital camera, power point presentations, the projector and the screen…."

4. Teacher has used handheld computers over the last year>   3
   Participant 3: "We have used the Dynavox."

<u>No near themes</u>

Table 6 (continued)

Question	Themes and Examples	Number

Q3. What do you feel are the main advantages
of using assistive technology?

    <u>Three themes</u>

1. AT helps children communicate.   8
   Participant 10: "That is the main thing—giving them a chance
     to communicate functionally."

2. AT provides access to curriculum content.   4
   Participant 4: "It is a way for non-readers to access content material…"

3. AT helps children do things that "regular" students/people can do.   3
   Participant 1: "… the ability to be able to spell just like students
     who do not have a disability."

    <u>Two near themes</u>

- AT helps a child to be more independent.
- AT enables a child to participate with other children.

Q4: What do you feel are the main
disadvantages of using assistive technology?

    <u>Three themes</u>

1. One disadvantage is that AT sometimes malfunctions.   5
   Participant 2: "How quick they break."

3. One disadvantage is the time required to use AT.   4
   Participant 9: "I would just say in time and programming the devices."

4. One disadvantage is not having the appropriate equipment.   3
   Participant 6: "… not having the type of device that you need for
     a particular child."

    <u>One near theme</u>

    Lack of training is a disadvantage

Table 6 (continued)

_____

Question	Themes and Examples	Number

_____

Q5. Do technical problems affect your
use of assistive technology?

    <u>Five themes</u>

1. Technical problems do affect the teacher's use of AT.   9
Participant 1: "Yes at times they do."

2. Technical problems occur not very often or sometimes.   6
Participant 3: "Maybe once a month."

3. Technical problems occur frequently/daily.   3
Participant 4: "Currently it is every day."

4. Technical problems sometimes involve equipment malfunction.   6
Participant 8: "… occasionally there will be a piece of equipment
   that just is not good…."

5. Much of the time the teacher can fix technical problems that arise.   5
Participant 10: "Generally I can fix them."

    <u>Five Near Themes</u>

- Teacher usually seeks help for technical problems.
- Devices sometimes get dropped.
- Some technical problems involve batteries.
- Setting up can be time-consuming.
- Some AT devices that teacher uses is outdated>.

Q6. How would you describe the support for
assistive technology that you receive from your school?

    <u>Six Themes</u>

1. Teacher receives fairly good to excellent support from school or school
system.   7
Participant 9: "I think that it is very supportive."

Table 6 (continued)

_____

Question	Themes and Examples	Number

_____

2. Teacher receives inadequate support from school.   3
    Participant 4: "It is very lacking."

3. Teacher needs support more for operating AT than for implementing it.   4
    Participant 2: "… mostly probably just operating it."

4. Teacher desires more one-on-one training/support at school.   3
    Participant 5: "Basically, just having someone who had a little
        more time to spend teaching me how to use the device."

5. Teacher requests AT support once or twice a month or less.   5
    Participant 6: "Once a month or so."

6. In teacher's school there is lack of understanding of AT use/significance   3
    Participant 4: "…there is probably nobody in my school who understands
    the need for special needs children to access the computer in their program."

    Three Near Themes

    - Teacher needs support more for implementing AT than for operating it.
    - Teacher needs support equally for operating and implementing AT.
    - Learning about and using AT devices is time consuming.

Q7. How well has your previous training in
assistive technology served you in the classroom?

    Eight Themes

1. Teacher's previous training has served him/her fairly well to well.   8
    Participant 8: "It has been good."

2. Teacher has had individualized training from an AT consultant or rep.   8
    Participant 7: "… one-on-one with some of the sales reps that
        sell assistive technology."

3. The most helpful training in AT has been one-on-one training.   6
    Participant 2: "To me it is best when someone comes into my room
        and can do it one-on-one,…"

Table 6 (continued)

_____

Question	Themes and Examples	Number

_____

4. Teacher's lack of training limits use of AT in the classroom.   6
   Participant 6: "Yes. The more you know about how to use different
   programs different ways the better off you are."

5. Teacher's lack of training does not limit use of AT in classroom.   3
   Participant 10: "No, because I have been able to get the training that I
       feel like I would need to use it."

6. Teacher has attended AT conferences or workshops.   4
   Participant 7: "I have gone to a lot of conferences,…"

7. Teacher has not attended any AT workshops.   3
   Participant 2: "I don't know that I have ever attended an official
   workshop on assistive technology."

8. Teacher's training in AT is old.   3
   Participant 4: "My previous training is several years old…"

   <u>Three Near Themes</u>

   - Teacher would like to learn about AT resources he or she is unfamiliar with.
   - Teacher learned most by actually using AT.
   - Teacher desires much more training.

Q8. Do time constraints affect your
use of assistive technology?

      <u>Three Themes</u>

1. Time constraints affect teacher's use of AT.   7
   Participant 6: "Yes. If they crash, it takes too long, you can't figure out
       what to do."

2. Time constraints do not affect teacher's use of AT.   3
   Participant 7: "Most of the ones that I have are fairly easy to program."

3. Time constraints come mainly from other teaching responsibilities.   5
   Participant 8: "A lot of it [time constraints] is from other teaching
       responsibilities…."

Table 6 (continued)

_____

Question	Themes and Examples	Number

One Near Theme

Time constraints come from both use of AT itself and teaching responsibilities.

Q9. Have you increased, decreased, or discontinued your use of assistive technology during the last school year?

Two Themes

1. Teacher has increased use of AT over the past year.   7
   Participant 5: "I would say I have increased."

2. Teacher's increased usage is partly due to his or her
   learning more about AT or devising new AT methods.>   4
   Participant 9: "Now that I have really become fluent in using
   the Dynavoxes, we use them consistently throughout the day."

One Near Theme

Teacher's use of AT over the past year has stayed about the same as before.

(Only one of the participants indicated that his or her use of AT had decreased.)

_____

Results in the Context of the Research Questions

Each subsection below focuses on one of the five research questions of the study.

In each case, the research question is answered based on the quantitative and qualitative

results.

Research question 1. The first research question is, "Why do the school's

teachers adopt assistive technologies initially?"

The responses to Section 1 of the online survey were especially relevant to answering this question. The six possible reasons that Section 1 presented to the participants for their consideration fell into two groups. One group of reasons consisted of factors closely related to the individual needs and desires of students. The most common response (129, 74.1%) belonged to this group: "The use of AT enables students to be able to show what they know." Also, 32 (18.4%) of the participants replied, "One or more students have asked to use it." In addition, of the 12 responses to this question that were written in by teachers, 11 referred to the value that AT has for the children who use it, with these teachers especially noting how it gives students access to the curriculum and encourages communication.

A second group of reasons among the six presented to the teachers in Section 1 consisted of reasons related to AT being mandated or expected by some entity such as the school, an Individual Education Plan, or parents. The second most common reason cited (104, 59.8%) was in this group: "AT is mandated for at least one student with an Individual Education Plan in my classroom." The third most common reply (51, 29.3%) was also in this group, "Parents of one or more students expect the use of AT for their child." However, none of the 12 teachers who wrote in responses to the question gave a reason that referred to anyone's or any entity's mandates or expectations.

These results suggest that the most prevalent reason for the teachers to initially employ AT in their classroom consists of the value that they perceive the technology has for their students. While AT's being mandated and expected to be used are also important reasons, they appear to be secondary. This conclusion is also supported by the results for Question 3 of the telephone interviews, which asked, "What do you feel are the main

advantages of using assistive technology?" The three themes that were identified in the responses to this question all referred to the value of AT for the children, such as its value in helping them communicate. This again suggests that for the teachers, a main reason for incorporating AT in the classroom is its value for the children who use it.

Research question 2. The second research question is, "What are teachers' attitudes and perceptions about the value of assistive technologies?"

The responses to the six questions in Section 2 of the online survey were especially relevant to answering this question. Results for Section 2 of the online survey indicated that the teachers had a generally positive attitude toward the value of assistive technology, with the mean for positive statements (4.12) being almost twice that for negative statements (2.21).

Results for Question 3 of the telephone interviews were also relevant for answering this research question. By asking the participants what they believed are the main advantages of using AT, it enabled them to state why they believed AT is valuable. The three themes that arose in their replies indicate that they felt that AT is valuable because it helps children communicate, gives them access to the curriculum, and helps them to do what other students can do.

Research question 3. The third research question is, "What are the challenges that teachers have experienced in adopting and implementing assistive technologies?"

The responses to the 12 questions in Section 3 of the online survey were especially relevant to answering this research question. This section measured teachers' perceptions about four challenges they may face in using AT: training, time constraints, technical problems, and support.

The quantitative results indicate that in regard to training, most of the teachers responded to Item 11 by indicating that they needed more professional development opportunities for learning how to use AT effectively. Eighty-six teachers agreed with this statement, and 53 strongly agreed, a total of 139 (80.3% of respondents to the question). In addition, 80 (46.0%) of the responding teachers disagreed or strongly disagreed with the Item 18 statement, "I have adequate training in and knowledge of assistive technology for classroom needs." Furthermore, 73 (42.2%) of responding teachers agreed or strongly agreed with the Item 15 statement, "I do not always understand how to differentiate a lesson by incorporating assistive technology." These results strongly suggest that many of the participants surveyed feel that they are in need of further training in the use of AT.

This conclusion is further supported by the results of the interviews. When asked how well their previous training in AT had served them, eight of the teachers said it had served them well or fairly well; however, six (60%) of the interviewed teachers also indicated that their lack of training limits their use of AT in the classroom. Two of those teachers indicated that they felt they needed much more training.

In regard to time constraints, the perceptions of the teachers are not so clear-cut. When presented with the statement (Item 12), "Assistive technology requires too much time to use," 117 (67.6%) of the 173 respondents disagreed or strongly disagreed. In response to Item 16, "By requiring so much extra time, using assistive technology slows the pace of learning for the class," 100 (57.5%) of the 174 respondents disagreed or strongly disagreed. However, in response to Item 20, "Time constraints prevent me from using assistive technology more often," only 59 (34.3%) of the 172 respondents disagreed or strongly disagreed, and 82 (47.7%) agreed or strongly agreed.

These results suggest that the main way that the time required to use assistive technology impacts a class is by sometimes preventing it from being used more often. This conclusion is supported by the results from the interviews where seven of 10 teachers said that time constraints affected their use of assistive technology. Both the time required to learn and use AT and other teaching responsibilities were mentioned as being involved in the time constraints.

In regard to technical problems, about one-third of the teachers who completed the online survey either agreed or strongly agreed that technical problems made them reluctant to use AT (Item 14, 57 of 171, 33.3%) or substantially reduced the value of AT in their class (Item 19, 58 of 173, 33.5%). In addition, 61 of 174 (35.1%) agreed or strongly agreed that "Too often, assistive technology does not operate properly" (Item 22).

A greater proportion (nine of 10, 90%) of participants who were interviewed believed that technical problems can affect the teacher's use of AT. However, six of those held that technical problems only occur sometimes or rarely, while only three held that they occur frequently or daily, and five stated that they could fix the problems much or most of the time.

In regard to support, the teachers' responses to the online survey indicated that the majority of them believed that receiving adequate support was a problem. A total of 101 (58.0%) out of 174 agreed or strongly agreed that they would use AT more frequently if there was more support for problems that arise (Item 13). Two-thirds (116 of 173, 67.1%) agreed or strongly agreed that they needed access to more resources to use AT effectively

(Item 17). Less than half (82 of 174, 47.1%) believed that they had adequate available assistive technology support (Item 21).

A greater proportion of interviewed teachers believed that their support was fairly good to adequate (seven of 10, 70%). However, three of the interviewees felt that the support they received was inadequate, and three expressed their desire for more one-on-one training and support at school.

In sum, all of the four kinds of factors that the study inquired about were felt to be challenges by a substantial number of the teachers who were surveyed and/or interviewed. However, the strongest challenges appears to be training and support, with the time constraints involved in learning and implementing AT a close second. Technical problems, though a factor for many teachers, appear to be the least problematic of the four.

Research question 4. The fourth research question is, "Have teachers discontinued or decreased the use of assistive technologies in their classrooms?"

The majority (115 out of 172, 66.9%) of the teachers surveyed had not decreased their classroom use of assistive technology in 2008-2009 compared to when it was first implemented, and 120 out of 172 (69.8%) had not discontinued any assistive technologies during the 2008-2009 school year. Furthermore, it was also found that seven out of the 10 interviewed teachers had actually increased their use of AT over the past year and only one teacher had decreased his or her use. This indicates that for the most part, despite various problems and issue, the teachers surveyed and interviewed did not decrease or discontinue their use of AT over the 2008-2009 school year. However, it was also found that almost a third of the teachers had either decreased their classroom use (57 of 172,

33.1%) in 2008-2009, or had discontinued their use of AT (52 of 172, 30.2%) during that school year.

Research question 5. The fifth research question was, "What are the factors that lead to decreased or discontinued use of assistive technology?"

Among the surveyed teachers, 57 out of 172 (33.1%) did report their use of assistive technology decreasing in 2008-2009 from when it was first implemented, and 52 of 172 (30.2%) reported that in 2008-2009 they discontinued use of some assistive technology that had been implemented during that school year. One of the main reasons for decrease or discontinuance mentioned by the teachers was simply the fact that one or more students no longer needed the technology. However, a number of teachers also cited other reasons for the decrease or discontinuance. Main issues and the number of times they were mentioned by surveyed teachers by indicating choices in the list of 17 provided them or in their written remarks are as follow.

3. Time issues (42).

4. Technical issues (32).

5. Lack of training in AT for the teacher or student (30).

6. Lack of staff, money, or facilities to support the technology (29).

7. The AT did not benefit the student, or student or parent rejected it (27).

8. Problems with transporting a device to/from different learning environments (26).

Notably, the most often cited reasons were the same four challenges that were the topic of Section 3 of the online survey.

Summary of the Chapter

This chapter reported the results of the online survey of AT teachers and the 10 interviews of teachers. Results were reported for the various parts of the online survey. This included reliability analyses of results for Sections 2 and 3 and the means and standard deviations for responses to items in Sections 2 and 3. The number of teachers who had decreased or discontinued their use of assistive technology was also reported along with their reasons for doing so.

The qualitative part of the study consisted of 10 interviews of teachers who used assistive technology. Themes of the interview responses were identified for each question, along with the number expressing each theme. Near themes were also identified for each question.

Based on these results, the five research questions were addressed and answered. These results will be discussed and several implications of the study will be drawn in the following chapter.

Chapter 5

Conclusions, Implications, Recommendations, and Summary

This chapter is divided into four main sections. The first of these presents the conclusions of the study. It reviews the main findings of the study and explains how the objectives of the study were achieved. The strengths, weaknesses, and limitations of the study are also discussed.

The second main section discusses the implications of the study. The findings are reviewed in light of previous studies. The contribution of the study to the use of assistive technology in K-12 schools is discussed, and particular attention is paid to the implications of the study in regard to the issues of training, time constraints, technical problems, and support.

The third main section of the chapter presents a number of recommendations. First, recommendations for further research are provided, and then several recommendations for professional practice are given based on the findings of the study.

Finally, the fourth section of the chapter presents a summary of the study. This review briefly explains the rationale for the study, its objective, the research questions, the methodology used, the major findings, and the implications of the study.

Conclusions

Addressing the objectives of the study. There were three primary objectives of this study. The first was to determine the abandonment rate for assistive technologies (AT) among teachers in Georgia who have used AT in their classrooms. Various rates for

discontinuing or decreasing the use of AT have been reported, but the reasons for teachers decreasing or discontinuing the use of AT have not been clear. Therefore, a second primary objective of the study was to determine the reasons that the surveyed teachers have had for discontinuing or decreasing their use of AT in the classroom. Both of these objectives were important because it is often teachers who have major decision-making authority about how and how much AT devices are used in the classroom (Bender Pape et al., 2002; Mansmann & Scholl, 2007). It was reasoned that by understanding teachers' reasons for discontinuing or decreasing the use of AT in their classrooms, it might be possible for schools and school districts to devise effective strategies to reduce the rate of such abandonment.

In trying to determine the reasons for decreasing or discontinuing the use of AT, the study also attempted to determine teachers' perceptions of various challenges that they may face in using AT. This was a third primary objective of the study. One such challenge consists of the technical problems that teachers may sometimes experience with AT equipment. Others include time constraints (Temple, 2006), lack of training (Ebner, 2004), and lack of available resources or outside support (Lee & Vega, 2005). Information about each of these factors was sought from AT teachers to help determine what role they may play in determining the extent of the teachers' use of AT in the classroom.

In regard to fulfilling the first objective of determining how many teachers had decreased or discontinued their use of one or more assistive technologies during the 2008-2009 school year in comparison to when they were first introduced, it was found that a total of 57 out of the surveyed 172 teachers (33.1%) had decreased their use of AT.

It was also found that 52 of the 172 teachers (30.2%) had discontinued use of AT during that school year. As for the 10 interviewed teachers, only one had decreased his or her use of AT during the 2008-2009 school year, while seven had increased their use of AT. Still, the almost one-third of teachers who reported decreased or discontinued use of AT during the previous school year was substantial and similar to the rate of 29% for abandonment of AT reported by Phillips and Zhao (1993).

In regard to fulfilling the second main objective of the study, which was to determine teachers' reasons for decreasing or discontinuing their use of AT in their classrooms, the most frequently reported reason on the online survey was simply that one or more students in the class no longer needed AT. However, there were also a number of other reasons for the decrease or discontinuance of use. Some of the major ones were:

- Use of AT required too much teacher time.

- One or more students and/or parents rejected the AT.

- Technical problems arose, such as breakage and missing accessories.

- The teacher or the student needed more training.

- There was a lack of staff or facilities to support the AT.

Included among these reasons for reducing or discontinuing the use of AT were the issues of time constraints, technical problems, need for training, and lack of adequate support. Each of these four factors is related to how difficult it is for teachers to implement a particular technology which, according to Smarkola (2008), influences their use of technology in the classroom. To determine the impact of these four factors on the teachers' use of AT was the third main objective of the study. These four factors were therefore studied more closely in Section 3 of the online survey, where it was found that

all four were considered to be challenges by a substantial number of both the surveyed and the interviewed teachers.

The need for further training in AT was one of the most problematic of the four issues, with most (80.3%) of the surveyed teachers agreeing in their responses that they needed more professional development opportunities for using AT effectively. In addition six of 10 (60%) of the interviewed teachers reported that their lack of training limited their use of AT in the classroom. This agrees with the results of other research, which has found that lack of knowledge (Temple, 2006) and lack of training (Ebner, 2004) are factors leading to discontinued or decreased use of AT.

Support was another major issue for the participants in the study, with 58% of teachers responding to the online survey reporting that they would use AT more frequently if there was more support for problems that arise, and 67% saying that they needed access to more resources in order to use AT effectively in the classroom. Only 47% of the participants felt they had adequate available assistive technology support. This finding agrees with that of Lee and Vega (2005), who also found that lack of outside support led to reduced use of AT among teachers. It should be noted, however, that only three of the interviewed teachers reported that they received inadequate support for AT.

The results of the study suggest that teachers may perceive time constraints to be less of a problem than the need for training and support. Temple (2006) found lack of time as a factor reducing use teachers' use of AT, yet almost 68% of the teachers responding to the present study's online survey disagreed with the idea that AT takes too much time to use. However, almost half (47.7%) of the survey respondents and seven of the interviewed teachers (70%) agreed that time constraints prevented them from using

AT more often in the classroom. This discrepancy may be due to some teachers interpreting the survey item about AT taking too much time to use as suggesting that the benefits of AT are not worth the time required to use it. Teachers could disagree with that statement, but at the same time agree that time constraints do affect their use of AT by preventing them from using it more often.

Overall, technical issues seemed to be the least problematic of the four kinds of challenge. About one-third of the surveyed teachers did agree that technical problems made them reluctant to use AT and reduced the value of AT in their class, one-third agreed that technical problems substantially reduced the value of AT in their class, and about 35% agreed that too often AT does not work properly. These percentages are generally lower than the proportion of participants reporting the other issues as being problems, but they are still substantial.

Despite these various problems, the attitude of the teachers toward AT was generally positive as measured by their online survey responses. This was indicated by their responses to items on Section 2. The mean of their agreement with positive statements about AT was almost twice the mean of their agreement with negative statements (4.12 versus 2.21). This is important because teachers' perceptions of the usefulness of technology affect how often it is used (Smarkola, 2008).

A main reason why the teachers were generally positive about AT was suggested by their responses to items in Section 1 of the online survey. These responses indicated that the primary motivation for the teachers to initially employ AT in their classroom was not because the AT was somehow mandated or expected by others, but rather that that they believed the technology would benefit the students. Teachers' responses to the third

interview question suggested that the main advantages they perceived for using AT was its value in helping students to communicate, access the curriculum, and be able to do what other students do.

Strengths, weaknesses, and limitations of the study. A major strength of this study was that it used a dual quantitative and qualitative methodology. Use of both kinds of method in a single study can be beneficial in modern research (Inu, 1996). By supplementing the results of the online survey with interviews of selected participants, the research was able to obtain a more detailed view of the perceptions of teachers who use AT in their classrooms. With the online survey being administered first, responses to the survey could be examined to help determine the most appropriate interview questions. In two cases especially, interview questions were purposely designed to provide more detailed information about an issue that had been treated more generally in the online survey. One of these issues was the nature of time constraints. While the online survey focused on time constraints as a more general potential problem, the interview questions attempted to distinguish time constraints caused by the use of AT itself from those that were brought about by the teacher's other duties. Also, in regard to administrative and school support of teachers using AT, the online survey dealt with support as a general issue, but the interview questions distinguished support for operating AT from support for implementing AT into the curriculum.

The inclusion of interviews also made it possible to have a better understanding of several other important factors that the online surveys did not address specifically. These included what kinds of AT devices the teachers had recently used, what particular advantages they felt AT devices provide to students who use them, how often technical

problems occur and whether teachers can often deal with them by themselves, the extent of training that the teachers had in AT, and what kind of training they felt was most valuable. All of this additional information helped to provide a deeper understanding of the issues that are faced by teachers using AT in the classroom, and such a deeper understanding is often an advantage in doing research (Inu, 1996).

A third strength of the study was that the researcher was knowledgeable about many facets of teachers using AT in the classroom based on his position as an assistive technology coordinator for a Georgia school district. Effective qualitative research demands a good understanding of what to ask of respondents and how to ask it, as well as the of the possible responses to expect (Mack, Woodsong, MacQueen, Guest, & Namey, 2005). The researcher's experience with classroom use of AT provided this understanding. This practical knowledge helped in determining appropriate questions for the online survey and interviews, and helped in the interpretation of the results.

A weakness of the study was that the number of school districts that agreed to be part of the study was less than was originally hoped for. Although all 189 school districts were contacted, only 28 agreed to allow teachers in their districts to take part in the study. This number was further reduced when AT coordinators in the 28 districts were asked to assist in the study and only 19 agreed. Others either expressly declined or did not respond to several e-mails attempting to enlist their assistance. As a result, the range of school districts that were represented in the study was less than optimal. However, the proportion of smaller to larger school districts represented among the 19 was similar to the proportion of smaller to larger school districts in the state of Georgia. With a smaller district being defined as one with less than 10 schools and a larger district as one with 10

or more schools, the state of Georgia has 49 large districts and 140 small districts. In comparison, the breakdown for this study was seven large and 12 small districts. Therefore, while approximately 74% of Georgia school districts are small, about 63% of this study's school districts were small, a difference of only 11%.

The total number of schools in the 19 school districts, which was 174 K-12 schools, was deemed satisfactory. The range of schools in the 19 districts was also satisfactory, with 96 elementary schools, 44 middle schools, and 34 high schools. However, the number of AT teachers who completed the online survey was less than expected. The total number of participants in the survey was 174, while the estimated minimum number that would be in the study was 225. Still, 174 was deemed to be a reasonable number of participants to provide a range of teachers working at different grade levels. This was confirmed by the teachers' responses to the survey's question about their primary grade level responsibility, with 50.6% designating pre-kindergarten to 5, 21.3% designating grades 6 to 8, 16.1% designating grades 9 to 12, and 12.1% designating pre-kindergarten through 12.

A second weakness of the study was that of those participants who agreed to be interviewed, the proportion that were from the researcher's own school district was higher than would normally be expected. This was a result of the aspect of the methodology that involved the assistant technology coordinator of a school district contacting AT teachers in district schools. Since the superintendent of the researcher's own school district agreed that the district could take part in the study and the researcher is the AT coordinator for that district, he was the one who contacted AT teachers in the district to inform them of the study. As a result, a disproportionate number of AT

teachers in the researcher's district agreed to be interviewed for the second phase of the study. When 10 interviewees were randomly selected out of those who had agreed to be interviewed, the result was that seven out of 10 of the interviewee participants taught at schools in the researcher's school district. This circumstance made the findings of the study, especially of the interviews, less generalizable to school districts across Georgia. In spite of this, the interviews provided important supplementary information that can help guide future studies about teachers' perceptions about using assistive technology in the classroom.

Implications of the Study

This study has several important implications. One of these follows from the result that the majority of participants of both the online survey and the interviews perceived that they had inadequate training in the use of AT and/or desired further training in how to use AT devices and incorporate them into the curriculum. Over 80% of online survey participants indicated that they wanted further training, and six of 10 interviewed participants desired additional training. These results strongly suggest that many teachers who use AT are under-trained.

The literature makes clear that ongoing training is important to develop teachers' ability to effectively and efficiently use AT devices in their classrooms. Lahm and associates (2001) pointed out that it is not enough for school systems to fund assistive technology devices and equipment; they must also provide funding for the human factor that is required to support the AT. Edyburn (2003) agreed, holding that while school systems and districts may increase their budget allotments for AT, it is also crucial to provide support for its use. A main aspect of this support is training. The teacher is the

one who is responsible for the often complex task of implementing AT devices and programs in the classroom and for ensuring that they work correctly, as well as for training students in the correct use and care of the technology (Carbone et al., 2007). In some cases, the teacher may also be responsible for installing the assistive technology. All of these aspects require considerable knowledge on the part of the teacher.

One way to help maintain and increase the knowledge base among teachers would be to arrange for them to attend workshops or conferences focusing on AT. Among the 10 interviewed subjects in this study, three indicated that they had gone to a number of such conferences or workshops, but an equal number stated that they had not attended any AT workshops, and three indicated that their training was several years old. These results suggest that there may be discrepancies among Georgia schools in regard to funding of opportunities for teachers to attend educational events focusing on AT. Such funding is important due to the ever changing landscape of assistive technology, with new hardware and software being constantly developed and introduced. Conferences and workshops are valuable ways to help keep teachers up to date on the latest technologies and best practices for implementing them in the classroom. Two of the interviewed teachers expressed their desire for additional training so that they could learn what assistive technologies were available that they were not aware of.

One of the main forms of training teachers in the use of AT consists of individualized training by an AT company representative or by a specialist such as a district AT coordinator who visits the teacher at his or her school to help inform the teacher about the correct use of a particular technology. Eight of the 10 interviewed teachers had experienced such training, and six indicated that individualized one-on-one

training was the most helpful kind of training for them. This is understandable since individualized training enables the teacher to ask an AT expert questions about the operation of the technology and how it can best be used for a student or students. While Georgia districts have been able to depend on considerable assistance from AT vendors in the past, unfortunately the recent downturn in the economy appears to have led some of these companies to cease or significantly reduce their training services due to financial considerations. Another main source of individualized training consists of district assistive technology coordinators. However, in Georgia, it is usual for only the larger school districts to have full-time coordinators devoted solely to AT. In many cases, the person in the district who oversees AT does so as one among many other duties. This results in less available time for the person coordinating AT for the district to help teachers understand the operation of the technology. Such coordinators may also have less available time themselves to keep abreast of the latest developments in the AT field.

The results of this study also make clear that in training teachers to use AT in the classroom, it is important to address the teacher's technical skills to accomplish trouble shooting. Nine of 10 interviewed teachers stated that the occurrence of technical problems affected their use of AT in the classroom, and three teachers indicated that technical problems arose frequently. While half of the interviewed teachers indicated that they could often fix technical problems that arose, two stated that they usually had to call on someone else for assistance. Developing teachers' expertise in this area can better enable them to deal with minor technical problems themselves, instead of having to wait for someone to assist them. This could save them considerable time. A teacher who is skilled in trouble shooting can often get a technology up and running and available to the

student, making the AT more effective. Furthermore, a degree of technical skill might help eradicate potential anxiety about the technology not operating correctly.

A second area in which it is important to build expertise among AT teachers is in the incorporation of AT into the curriculum in order to differentiate lessons between AT users and the rest of the class. Over 42% of the online survey participants agreed that they needed more knowledge about how to differentiate a lesson by incorporating AT. Such knowledge can help to alleviate one of the main issues affecting the use of AT in the classroom, which is the amount of additional time that is typically required to implement the technology. Almost half of the online survey participants agreed that time constraints prevented them from using AT more often, and seven of the 10 interviewed teachers felt that time constraints affected their use of AT. Five of the interviewed teachers indicated that the time pressure mostly came from their other teaching responsibilities. Those constraints can be substantial given the many time-consuming classroom duties that teachers typically have. To set up an AT device so that it enables a student to access the same curriculum as other students in the class often involves considerable additional time programming the device. Training that can assist teachers to differentiate lessons more quickly and efficiently could help reduce the extra time required to implement AT in the classroom.

Reducing a teacher's time to differentiate lessons by providing additional training might also lead to greater use of AT by the teacher. Temple (2006) previously found that lack of time affected teachers' use of AT, and in the present study, the results of the online survey suggested that due to the extra time required to implement AT in their classrooms, teachers used it less than they would otherwise. In particular, almost half

(47.7%) of the online survey respondents agreed that time constraints prevented them from using AT more often, and seven out of 10 interviewed teachers said that time constraints affected their use of AT. Such reductions in usage are unfortunate because they reduce the value of the considerable investment that schools make in assistive technologies (Meeks, 2007). They also reduce the amount of time that students who need the technology are able to use it. In fact, any education or training that helps teachers to better understand, implement, and deal with AT in the classroom is likely to reduce the extra amount of time it requires and result in greater use.

The results of the study suggest that another factor that reduces the time that AT is used in the classroom is inadequate support, a factor that had previously been identified by Lee and Vega (2005). In the present study, 58% of the online survey participants agreed that they would use AT more frequently if there were more support for problems that arise, and less than half believed that they had adequate AT support. Although seven of the 10 interviewed teachers felt that their support was adequate, the others did not, and comments by two of those teachers suggested that the administration had an unclear understanding of the value of AT for students. These results imply that the degree of administrative and technical support that AT teachers receive in Georgia varies considerably, and that perceived inadequate support can lead to reduced use of AT by teachers. This highlights the importance for administrations to provide not only effective training support, but also adequate technical support for teachers using AT. The provision of ongoing support would provide a scaffold to teachers acquiring new knowledge, reinforcing skills, and addressing technical issues. The provision of structured on-going support would also demonstrate a commitment on the part of the administration.

Finally, it is important to note that at present, much of the support for AT teachers in many Georgia school districts comes through AT coordinators. To increase the number of districts with a full time AT coordinator would be a major step in helping teachers to deal with the challenges they face in using AT in the classroom. Furthermore, it is important that districts with AT coordinators utilize their efforts in creative and effective ways. An example would be for AT coordinators to address the crucial issue of the extra time it often requires to use AT by helping teachers to find and modify existing materials rather than the teacher having to re-create materials for a particular AT implementation. A way to approach this would be for the AT coordinator to organize a materials bank at a single location within the school district and be the contact point for adding materials and helping teachers to locate appropriate materials.

Recommendations

Recommendations for further research. Several recommendations can be made for further research based on the results of this study. First, it is recommended that the study be repeated over a larger geographical area. One way to do this would be to randomly choose school districts in several different states in each of two or more regions of the country. In this way, the study could help determine if there are regional differences in teachers' attitudes toward and perceptions about the use of AT in the classroom.

Second, it is recommended that a similar study be done in Georgia that distinguishes the responses of AT teachers in larger school districts (10 or more schools) from those in smaller districts (fewer than 10 schools). The reason behind this recommendation is that larger school districts in Georgia generally have a full-time AT

coordinator, while smaller districts do not, and this might make a difference in teachers' attitudes and perceptions about AT. The present study was not designed to make the distinction between teachers in the two different sizes of district, but one that did make that distinction might be able to determine if there are differences in the attitudes and perceptions about the use of AT in the classroom between teachers in small districts and those in larger districts.

Third, it is recommended that an in-depth study be conducted on the extent of training received by Georgia teachers who use AT in their classrooms. Two of the main results of this study were that most of the surveyed teachers felt that they needed more training in AT, and the interviewed teachers appeared to have varying degrees of training. This is even more significant given that prior research (Ebner, 2004; Temple, 2006) has identified teachers' lack of knowledge and training s factors limiting use of AT. It would be valuable to understand in greater depth just how much and what kinds of training in AT Georgia teachers are receiving in order to determine what may need to be done to improve their training.

Fourth, it is recommended that an in-depth study be conducted to better determine the time constraints that AT teachers must deal with. The motivation for conducting such a study follows from another important result of this study, which was that for some teachers, the extra time required to use AT has the effect of reducing the use of AT in the classroom. This finding agrees with previous results reported by Temple (2006). By gaining a better understanding of how much extra time is needed to implement AT in the classroom and how the required time varies with the kind of AT being used and other variables, it might be possible to devise strategies and techniques to reduce that time.

Recommendations for professional practice. There are several recommendations for professional practice that can be made based on the results of this study. First, it is recommended that school administrators in Georgia and elsewhere carefully review the results of this study in order to better understand the challenges that teachers who use AT in the classroom are facing and to gain an overview of the teachers' major concerns.

Second, it is recommended that school principals and other administrators review the extent of professional development opportunities that their schools and school districts are offering teachers who use AT in the classroom and that they provide further training where needed. A major finding of the study was that most of the surveyed teachers felt that they needed more training. Furthermore, three of the 10 interviewed teachers reported never having attended an AT workshop or conference, three felt that their AT training was old, and two reported wanting additional training so they could learn what new AT technologies might be available. Furthermore, it was found that the extra time it takes to implement AT hindered the use of AT in the classroom, and it seems likely that the more training teachers have, the less extra time it will require to implement the AT. Adequate training is even more important today with the apparent decrease in in-school training of teachers by AT vendors.

Third, it is suggested that administrators understand as much as possible about the AT that is being used in their schools. Three of the 10 interviewed teachers expressed their perception that there is a lack of understanding of the use or significance of AT in their schools. Such teachers may feel that their efforts are not adequately understood by principals or other administrators. Given the extra time and work it often requires to

implement AT in the classroom and the relation of AT use to the time required to use it, it is important for teachers to perceive that their efforts are understood and appreciated.

Fourth, it is recommended that school district administrators ensure that there is someone in their district or in each school who is technically proficient in assistive technologies and who can also be made available to assist teachers when technical problems arise. This is especially important for smaller districts without a full-time assistive technology coordinator. This study found that about one-third of surveyed participants perceived that technical problems made them reluctant to use AT, and nine of 10 interviewees held technical problems can affect their use of AT. Providing assistance for technical problems is a main way in which school districts and schools can provide support for teachers who use AT.

Summary of the Study

This study focused on the attitudes and perceptions of Georgia K-12 teachers who use assistive technologies in their classrooms. The study was motivated by research results suggesting that the rate of abandonment of AT, meaning that an AT item either goes unused or its use is discontinued, is high (Verza et al., 2006; Wessels et al., 2003). Phillips and Zhao (1993) reported an abandonment rate of at least 29% after implementation of classroom technologies, and other research suggests that the rate may be much higher (Ebner, 2004; Verza et al., 2006). Such abandonment is an important issue for schools since the investment a school or school district makes in AT can be considerable, and if the technology goes unused, the value of the investment is decreased. Furthermore, children who could benefit from the use of AT cannot realize those benefits if the technology sits unused.

In light of research suggesting that the AT abandonment rate may be high, this study sought to determine the rate at which AT implemented in Georgia classrooms has subsequently been discontinued or used less than before. The study also sought to determine the reasons that Georgia teachers have had for discontinuing or decreasing use of AT in the classroom. It was believed that focusing on AT teachers was appropriate since classroom teachers generally have considerable authority to decide what assistive technologies will be implemented in the classroom, and to what extent (Bender et al., 2002; Mansmann & Scholl, 2007). Understanding teachers' reasons for discontinuing or decreasing AT, might help in developing strategies to reduce the abandonment rate.

The study also examined teachers' attitudes, perceptions, and concerns about using AT in the classroom. It sought to measure teachers' general attitudes toward the use of AT, along with their perceptions about four kinds of challenge they may face in using AT: training, technical problems, time constraints, and the support and/or resources provided by the school and/or the school district. How these various challenges affect teachers' use of AT was of primary interest.

The study used a dual quantitative and qualitative method to answer five research questions. The quantitative part of the research consisted of an online survey that was developed by the researcher. After several demographic questions, the survey consisted of five sections of items, corresponding to the five research questions. In Section 1, teachers marked or stated their reasons for adopting AT. Sections 2 and 3 consisted of statements reflecting attitudes toward AT and perceptions of the four kinds of challenge. Teachers responded on a five-point Likert scale measuring agreement or disagreement with the statements. Section 4 consisted of two yes-no questions about discontinued or

decreased use of AT, and in Section 5 teachers reported their reasons for discontinued or decreased use. The survey was examined for validity by a three-member expert panel and several changes were made on the basis of its feedback. In addition, a pilot study was done to ensure that the online survey format worked properly.

The procedure to gain participants for the study began with contacting the superintendents of each of the 189 Georgia school districts to ask if teachers in district schools could take part in the study. After 28 superintendents agreed, the assistive technology coordinators for those districts were contacted and asked to send information about the study to teachers who used AT in their district. Nineteen AT coordinators agreed. The final number of teachers who completed the online survey was 174. Reliability analyses of the teachers' responses confirmed that Section 2 items measured only one construct and that each of the four sets of three questions in Section 3 that were intended to measure four challenges that AT teachers face measured only one construct.

The qualitative part of the study consisted of brief telephone interviews with 10 of the teachers who had completed the online survey. Teachers were asked nine questions, along with probe questions, about their perceptions of AT and whether they had recently discontinued or decreased their use of AT. Responses were audio recorded, transcribed, and examined to determine themes among responses. Using the three-part analytical method suggested by Huberman andMiles (1984), themes were defined as the same or very similar ideas expressed by three or more teachers for a particular question.

Based on the results of the online survey and the interviews, the five research questions were answered. In regard to the first research question of why do the school's teachers adopt assistive technologies initially, the results indicated that the most

important reason teachers initially use AT in their classroom is that they perceive that the technology has value for their students. The technology's being mandated is another important reason, but is secondary.

In answering the second research question, about teachers' attitudes and perceptions about the value of assistive technologies, it was found that the teachers who responded to the online survey had mostly a positive attitude toward the value of assistive technology. Themes that arose in the interviews indicated that teachers believe that AT is valuable because it helps children to communicate, provides greater access to the curriculum, and enables them to better accomplish what other children can.

The third research question asked the teachers about what challenges they had experienced in adopting and implementing assistive technologies. Section 3 of the online survey measured the teachers' perceptions about four potential challenges: training, time constraints, technical problems, and support. In regard to the first challenge, training, most of the teachers indicated their need for more professional development opportunities for learning how to use AT effectively and disagreed that they had adequate training in and knowledge of AT for classroom needs. Overall, the results indicate that a majority of the teachers believed they needed additional training in using AT in the classroom.

In regard to the second challenge, time constraints, about two-thirds of the online survey participants disagreed that AT requires too much time to use, but almost half agreed that time constraints prevented them from using assistive technology more often. In addition, seven of the 10 interviewed teachers said that time constraints affected their use of AT.

In regard to the third challenge, technical problems, about one-third of the teachers completing the online survey agreed that technical problems affected their use of AT. Nine out of 10 interviewed teachers agreed with this.

In regard to the fourth challenge, support, 58% agreed that they would use AT more frequently if there was more support when problems arose, and less than half perceived that they had adequate AT support. Furthermore, two-thirds agreed that they needed access to more resources to effectively use AT, while three of the 10 interviewed teachers felt that they received inadequate support.

Overall, the results showed that for each factor, training, time constraints, technical problems, and support, a substantial number of teachers felt that it was an issue in using AT in the classroom. Training and support were the two challenges perceived by the greatest number of teachers.

Research Question 4 was whether teachers had discontinued or decreased the use of assistive technologies in their classrooms. The results indicated that most of the teachers had neither decreased nor discontinued use of AT during the 2008-2009 school year; however, the rate of decreased or discontinued use of AT over the previous school year was similar to the 29% reported by Phillips and Zhao (1993).

Research Question 5 asked what factors led to decreased or discontinued use of assistive technology. Among the surveyed teachers, about one-third reported that their use of AT had decreased, and almost 30% reported that they had discontinued use of some assistive technology. Aside from the circumstance of no student in the class needing AT, four other main reasons for decreasing or discontinuing use were the four challenges time, technical problems, lack of training, and lack of support.

Based on the results, this study had several implications. One of these concerned training. While the literature indicates that ongoing training is very important for teachers to effectively use AT in the classroom (Lahm, et al., 2001; Edyburn, 2003), many of the teachers in this study appear to be under-trained. Thus, it appears that Georgia school districts and schools may differ in the opportunities they provide for training teachers in using AT. Even in regard to individualized training, which the results suggest that many teachers prefer, there appears to be less such training than before due to apparent decreases in training efforts by AT vendors following the economic downturn.

The results of the study also imply that training of teachers should address their ability to do minor trouble shooting of AT equipment. This could be a time saver and help eradicate potential anxiety about using AT correctly. Training should also include lesson differentiation, which many teachers in this study agreed they need more knowledge about. This too could help reduce the time required to implement AT in the classroom, which the study found affects its use. Training teachers in minor trouble shooting and in differentiating lessons could therefore lead to greater use of AT in their classrooms, protecting the school's investment and making the technology more available to those who need it.

In addition, the results of this study imply that there is a need for greater administrative and technical support for teachers who use AT. The findings indicated that lack of support can lead to reduced use of AT, but the amount of support available appears to vary within Georgia school districts and schools. It is important for administrators to provide both effective training and adequate technical support.

Finally, several recommendations for further research and for professional practice were made. In regards to research, it was recommended to (a) repeat this study over a larger geographical area, (b) do a similar study distinguishing responses from teachers in larger school districts from those in smaller, (c) conduct research on the extent of AT training received by Georgia teachers, and (d) do a study focusing on the kinds of time constraints teachers using AT must deal with.

In regard to professional practice, it was recommended that school administrators (a) carefully review this study to learn AT teachers' major concerns, (b) review the training opportunities they provide AT teachers and provide further training where needed, (c) understand as much as possible about the AT used in their schools, and (d) ensure that someone technically proficient in AT be available to teachers at all schools. By taking these steps, administrators would be making a strong statement of support for teachers who use AT in their schools.

Appendix A

Institutional Review Board Approval

NOVA SOUTHEASTERN UNIVERSITY
Office of Grants and Contracts
Institutional Review Board

MEMORANDUM

To: Michael Sharpe
P.O. Box 4506
Macon, GA 31204

From: Teri Hamill, Ph.D.
Chair, Institutional Review Board

Date: March 31, 2009

Re: *Assistive Technology Attrition: Indentifying Why Teachers Abandon Assistive Technologies* - Research Protocol No. SCIS02050905Exp.

I have reviewed the revisions to the above-referenced research protocol by an expedited procedure. On behalf of the Institutional Review Board of Nova Southeastern University, *Assistive Technology Attrition: Indentifying Why Teachers Abandon Assistive Technologies* is approved in keeping with expedited review categories #6 and #7. Your study is approved on **March 31, 2009** and is approved until **March 30, 2010**. You are required to submit for continuing review by **February 28, 2010**. As principal investigator, you must adhere to the following requirements:

1)   CONSENT: You must use the stamped (dated consent forms) attached when consenting subjects. The consent forms must indicate the approval and its date. The forms must be administered in such a manner that they are clearly understood by the subjects. The subjects must be given a copy of the signed consent document, and a copy must be placed with the subjects' confidential chart/file.

2)   ADVERSE EVENTS/UNANTICIPATED PROBLEMS: The principal investigator is required to notify the IRB chair of any adverse reactions that may develop as a result of this study. Approval may be withdrawn if the problem is serious.

3)   AMENDMENTS: Any changes in the study (e.g., procedures, consent forms, investigators, etc.) must be approved by the IRB prior to implementation.

4)   CONTINUING REVIEWS: A continuing review (progress report) must be submitted by the continuing review date noted above. Please see the IRB web site for continuing review information.

5)   FINAL REPORT: You are required to notify the IRB office within 30 days of the conclusion of the research that the study has ended via the IRB Closing Report form.

The NSU IRB is in compliance with the requirements for the protection of human subjects prescribed in Part 46 of Title 45 of the Code of Federal Regulations (45 CFR 46) revised June 18, 1991.

Cc: Dr. Ling Wang (email only)   Dr. Laurie Dringus (email only) Mr. Jaime Arango

Appendix B

Letter to Superintendents

Dear Superintendent,
I am a doctoral student in the Graduate School of Computer and Information Sciences at Nova Southeastern University. I am also an Assistive Technology Specialist for Bibb County, here in Georgia. I am currently working on research to identify why teachers abandon assistive technologies. Although previous research has been conducted on assistive technology abandonment, apparently no research has specifically examined the reasons for teachers' decisions to persist with or abandon assistive technology. My research will investigate this issue through an online survey intended for Georgia teachers who have used or currently use assistive technology at the kindergarten through twelfth grade level.

The research is designed to include teachers from schools throughout Georgia. The procedure will begin with randomly selecting 150 Georgia public schools. The assistive technology coordinators for the counties in which those schools operate will then be asked to identify and forward an email to teachers in those schools who have used or currently use assistive technology. The email will explain the study, provide the online location of the survey, and ask for the teachers' cooperation in completing the survey. The teachers will then decide whether or not to take the survey.
In order to implement this design, I am requesting your permission to include in my research teachers in schools in your county in the event that any of those schools are selected. The survey should take a maximum of 10 to 15 minutes to complete and teachers will be able to take the survey at their convenience, so participation will not affect instructional time.

Teachers who complete the survey will be asked at the survey's end if they would be willing to participate in a brief telephone interview and, if so, to provide their email address. In the data retrieval process, these email addresses will be transferred to a separate file and be randomized so that it will be impossible to associate addresses with survey responses. A random selection will be made from those who are willing to participate in a telephone interview, and telephone interviews will be held at a time convenient for the participant. Interviews will last a maximum of 15 minutes. Anonymity will be guaranteed to participants, the schools, and the counties, and no identifiable information in regard to any of these will be included in any results or associated publications.

Your assistance is very important to my research and would be greatly appreciated. I am asking for your reply by February 16, 2009, so that I may provide a timely response to the Institutional Review Board at Nova Southeastern University. I appreciate your time in reading and considering my request. Please reply by e-mail to michshar@nova.edu.

Sincerely,
Michael Sharpe

Appendix C

Letter to Expert Panel

Michael Sharpe
P.O. Box 4506
Macon Georgia 31208-4506

August 12, 2010

[Click **here** and type recipient's address]

Dear

I am a doctoral student in the Graduate School of Computer and Information Sciences at Nova Southeastern University. I am currently working on research to study Assistive Technology Attrition: Identifying Why Teachers Abandon Assistive Technologies. An online survey will be used to obtain responses from teachers at the Kindergarten through 12th grade level.

Although previous research has been conducted on technology abandonment, no research has been identified that specifically examined teachers' decisions to persist with assistive technology or to abandon it; thus, no appropriate questionnaire or interview guide currently exists that can be used for the study. I am therefore attempting to construct a valid survey instrument to be used in my study.

I am requesting your assistance in reviewing my draft survey instrument to help ensure that its questions are accurately focused on the constructs that they are intended to measure. You were selected because of your knowledge, experience, and contribution to the field of Assistive Technology.

I have attached the draft survey instrument, along with a brief explanation of the constructs the instrument is intended to measure. If you would agree to review the questions for validity and provide me your feedback, I would greatly appreciate it.

Due to your interest in this area, I would welcome the opportunity to provide you with a summary of the results of my study when they are complete.

Thank you for your time and consideration of this request. I look forward to hearing from you at michshar@nova.edu.

Sincerely,

Michael Sharpe

Appendix D

Explanation of Survey for Expert Panel

Dear assistive technology expert,

Responses to the survey instrument below, which will be distributed to K-12 teachers who have used or are using assistive technology in the classroom, are meant to answer five research questions:

1. Why do teachers adopt AT initially?
2. What are their attitudes and perceptions about the value of AT?
3. What challenges have they experienced in adopting and implementing AT?
4. Have they discontinued or decreased the use of AT?
5. For those who have discontinued or decreased the use of AT, what factors led to them doing so?

The survey instrument is composed of six sections. The first of these is the demographic section. Each of the other five sections corresponds to one of the research questions.

Sections two, five, and six consist of Yes-No questions. Sections three and four consist of questions using a five-point Likert scale.

The five Likert-scaled items in section three are meant to measure a single construct: What are teachers' attitudes and perceptions about the value of AT?

The twelve Likert-scaled items in section four are meant to measure teachers' perceptions of the challenges presented by assistive technology. The items are intended to measure four constructs that previous studies suggest may be related to abandonment of AT. These are: time constraints, lack of support, lack of adequate training, and technical difficulties.

Please examine the survey very carefully and provide your feedback concerning how accurately the questions in the various sections of the draft survey measure what they are intended to measure—including whether the Likert-scaled items are likely to measure the constructs they are meant to measure. Your feedback will be integral to the development of an accurate survey instrument.

Thank you for your assistance.

Michael Sharpe

Appendix E

Letter to Assistive Technology Coordinators

Michael Sharpe
P.O. Box 4506
Macon Georgia 31208-4506

August 12, 2010

Dear Assistive Technology Coordinator,

I am a doctoral student in the Graduate School of Computer and Information Sciences at Nova Southeastern University. I am also an Assistive Technology Specialist for Bibb County, here in Georgia. I am currently working on research to identify why teachers abandon assistive technologies. Although previous research has been conducted on assistive technology abandonment, apparently no research has specifically examined the reasons for teachers' decisions to persist with or abandon assistive technology. My research is designed to investigate this area through an online survey intended for Georgia teachers who have used or currently use assistive technology at the Kindergarten through 12th grade level.

Among the schools randomly selected to be included in the study are [Fill in name(s) of school or schools selected in recipient's county], in your county. I am requesting your assistance to identify teachers who have used or currently use assistive technology in [this school or these schools], and to forward to them a prepared e-mail that I can provide you that explains the study and asks for their participation. The survey should take a maximum of 10-15 minutes to complete. Some participants may be asked to answer follow-up questions at a later date, although their participation in that phase of the survey will be optional. Anonymity is assured to participants, and no identifiable information will be included on any results or publications.

I realize your time is valuable, so I want to emphasize that your assistance will be limited to forwarding the furnished e-mail to those in the selected school(s) in your county who have used or currently use assistive technology in their classrooms. The e-mail will explain the nature and importance of the study, assure anonymity to participants, and provide directions for completing the survey.

Your assistance is very important to my research, and would be greatly appreciated. If you will agree to assist me, please e-mail me at michshar@nova.edu, and I will send you the e-mail to be forwarded to teachers who have used or currently use assistive technology in their classrooms.

Sincerely,

Michael Sharpe

Appendix F

Letter to Teachers

Michael Sharpe
mesharpe@bellsouth.net
P.O. Box 4506, Macon Georgia 31208-4506
478-951-4385
Date

Dear Fellow Educator:

I am a doctoral student in the Graduate School of Computer and Information Sciences at Nova Southeastern University. I am also an Assistive Technology Specialist for Bibb County, here in Georgia. I am conducting research to identify why teachers abandon assistive technologies. Although previous research has been conducted on assistive technology abandonment, apparently none has examined the reasons for teachers' decisions to persist with or abandon assistive technology. My research will investigate this area with a questionnaire intended for Georgia teachers who have used or currently use assistive technology at the Kindergarten through 12th grade level.

You have been identified as such a teacher, and I am asking for your assistance in completing my research. Your time is valuable, and to expedite this process I have developed an online questionnaire about the use of assistive technology in the classroom. Completing the questionnaire should take no more than 15 minutes of your time. The data collected will not be identifiable by teacher or school. Confidentiality and anonymity of responses will be observed throughout the process.

Near the end of the questionnaire, there will be an opportunity for you to extend the parameters of the study by agreeing to participate in a 15-minute telephone interview by indicating your e-mail address so that I may communicate with you about setting up a time for the interview. While completely optional, this interview could better frame the findings of the questionnaire. If you choose to participate in this part of the research, your e-mail address will be kept strictly confidential. No identifiable information from the interviews will be reported, and you will remain anonymous.

Whether or not you agree to be interviewed later, your assistance in completing the online questionnaire is crucial to my research. I would greatly appreciate it if you would complete the questionnaire within the next seven days at the following online location [link to be determined]. Instructions are provided throughout the survey.

Thank you,

Michael Sharpe,
Ph.D. Candidate, Nova Southeastern University

Appendix G

Assistive Technology Survey

Please Note: Your participation in this survey is completely voluntary. Your anonymity is guaranteed and your confidentially is assured by the researcher. The time to complete this questionnaire is approximately 15 minutes. Your completing this survey indicates your voluntary consent to participate in this research study.

Demographic Questions

Instructions: For each of the items below, please check the box that most accurately reflects your position and experience.

1. Which category best describes your primary grade level?

[- select one -]
☐ Elementary grades (PreK–5)
☐ Middle grades (Grade 6 -8)
☐ High school (Grade 9-12)
☐ All grade levels (PreK–Grade 12)

2. How many years of experience do you have in education?

[- select one -]
☐ Less than 5 years
☐ 5 to 9 years
☐ 10 to 20 years
☐ More than 20 years

3. How many years of experience do you have using assistive technology?

[- select one -]
☐ Less than 5 years
☐ 5 to 9 years
☐ 10 to 20 years
☐ More than 20 years

Section One

4. I have adopted assistive technology (AT) in my classroom for the following reasons

(please check all of the statements below that apply to you):

a. _____ AT is mandated for at least one student with an Individual Education Plan in

my classroom.

b. _____ The use of AT enables students to be able to show what they know.

c. _____ The administration expects or requires me to use AT in my classroom.

d. _____ One or more students have asked to use it.

e. _____ The use of AT is part of teacher evaluation in our school.

f. _____ Parents of one or more students expect the use of AT for their child.

e. Other reasons (please state all): _____

_____

_____

Section Two

Instructions: For each item in this section, choose the answer that best reflects your
beliefs and attitudes according to the following scale

1–Strongly disagree, 2–Disagree, 3–Neutral, 4–Agree, 5–Strongly Agree

5. The difficulties of implementing assistive technology outweigh its benefits.

○ 1   ○ 2   ○ 3   ○ 4   ○ 5

6. Assistive technology is often an effective teaching tool for the student to access the curriculum.

○ 1   ○ 2   ○ 3   ○ 4   ○ 5

7. Use of assistive technology makes students reliant on the tool and negatively affects their skill development.

○ 1   ○ 2   ○ 3   ○ 4   ○ 5

8. The pedagogical value of assistive technology is often over rated.

○ 1   ○ 2   ○ 3   ○ 4   ○ 5

9. I have seen students progress because of their use of assistive technology.

○ 1   ○ 2   ○ 3   ○ 4   ○ 5

10. Assistive technology can be valuable for students at any grade level.

○ 1   ○ 2   ○ 3   ○ 4   ○ 5

Section Three

Instructions: For each item in this section, choose the answer that best reflects your beliefs and attitudes according to the following scale.

1–Strongly disagree, 2–Disagree, 3–Neutral, 4–Agree, 5–Strongly Agree

11. I need more professional development opportunities for learning how to use assistive technology effectively.

    ○ 1   ○ 2   ○ 3   ○ 4   ○ 5

12. Assistive technology requires too much time to use.

    ○ 1   ○ 2   ○ 3   ○ 4   ○ 5

13. I would use assistive technology more frequently if there was more support to help me with problems that arise.

    ○ 1   ○ 2   ○ 3   ○ 4   ○ 5

14. I am sometimes reluctant to use assistive technology because it frequently does not work correctly.

    ○ 1   ○ 2   ○ 3   ○ 4   ○ 5

15. I do not always understand how to differentiate a lesson by incorporating assistive technology.

    ○ 1   ○ 2   ○ 3   ○ 4   ○ 5

16. By requiring so much extra time, using assistive technology slows the pace of learning for the class.

    ○ 1   ○ 2   ○ 3   ○ 4   ○ 5

17. I need access to more resources (e.g., personnel, premade lessons, technical support) to be able to use the available assistive technology resources effectively as part of my instructional day.

    ○ 1   ○ 2   ○ 3   ○ 4   ○ 5

18. I have adequate training in and knowledge of assistive technology for my classroom needs.

○ 1　　　　○ 2　　　　○ 3　　　　○ 4　　　　○ 5

19. Recurring technical problems substantially reduce the value of assistive technology in my class.

○ 1　　　　○ 2　　　　○ 3　　　　○ 4　　　　○ 5

20. Time constraints prevent me from using assistive technology more often.

○ 1　　　　○ 2　　　　○ 3　　　　○ 4　　　　○ 5

21. Adequate assistive technology support is available to me.

○ 1　　　　○ 2　　　　○ 3　　　　○ 4　　　　○ 5

22. Too often, assistive technology does not operate properly.

○ 1　　　　○ 2　　　　○ 3　　　　○ 4　　　　○ 5

Section Four

Instructions: For each statement in this section, please check Y if you agree with the statement, or N if you disagree with the statement.

23. As the 2008-2009 school year progressed, students' use of assistive technology in my classroom decreased from its use when it was first implemented.

☐Y　　　　☐N

24. One or more of the assistive technologies that were implemented for students in my class during the 2008-2009 school year were discontinued during that same school year.

☐Y   ☐N

Section Five

25. If you answered Y to question 23, 24, or both, please indicate below the reasons for the reduction in AT usage and/or its discontinuance (check all that apply):

☐ Use of assistive technology makes students reliant on the tool and negatively affects their skill development.

☐ The AT device(s) was (were) too difficult to transport between classes or learning Environments.

☐ One or more students using the AT no longer needed it.

☐ One or more students and/or parents rejected the AT.

☐ AT required too much teacher time

☐ AT was not beneficial for the student(s).

☐ AT accessories were missing and not replaced (e.g., cables to transfer data, manual, batteries).

☐ One or more AT devices broke and was not repaired.

☐ One or more students forgot to bring the AT tool to class.

☐ I needed more training in AT and it was not available.

☐ The school system could not provide the money to support the technology.

☐ The student(s) needed more training in AT and it was not available.

☐ There was not enough instruction time to use AT.

☐ AT caused a disruption in the classroom.

☐ Use of AT is not "real life," and the student needs to learn to function without it.

☐ Not enough staff was available to support the use of AT.
☐ AT hindered instructional time.

☐ Other (please state all other reasons):_____

_____

Completion Once you have pressed the "Submit" button you will have completed the online survey. Your time and willingness to assist in this research is greatly appreciated.

Please Note: If you are willing to participate in an additional 15-minute telephone interview about Assistive Technology, please enter your e-mail address in the box below. If you do so, your e-mail address will be transferred into a randomized file and will not be associated in any way with your responses to the survey questions. The researcher will use your e-mail address only to contact you about a possible telephone interview. Your e-mail address will be held strictly confidential, and your anonymity will be assured in any future interview participation.

Your email: [   ]

[Submit]

_____

Appendix H

Interview Guide

(Optional probe questions are to be asked if it is
deemed that further information is needed.)

Opening Statement: "Hello. I want to thank you for agreeing to be interviewed for my study. Before we proceed, I must ask again for your agreement to this interview being audio recorded. I want to reiterate that your identity will remain totally anonymous. May I again have your agreement to audio record the interview? … Thank you. The total time we will need for the interview should not exceed 15 minutes. I will ask you several questions about your use of assistive technology in your classes. There are no right or wrong answers. What's important is that you respond candidly to the questions so I can understand your actual views."

1. How many years have you used assistive technology in your classes?

2. What kinds of assistive technology have you used in your classes over the last year?

3. What do you feel are the main advantages of using assistive technology?

   Probe question: If the reply is unclear or very brief, ask for elaboration.

4. What do you feel are the main disadvantages of using assistive technology?

   Probe question: If the reply is unclear or very brief, ask for elaboration.

5. Do technical problems affect your use of assistive technology?

   Probe question: How often do you have technical problems with assistive technology?
   Probe question: What kinds of technical problems do you experience?
   Probe question: Are the technical problems you encounter usually ones you can fix, or must you solicit help?

6. How would you describe the support for assistive technology that you receive from your school?

   [If the teacher indicates that there could be improvement, but isn't clear about what kind of improvement, then ask one or more of the following questions:]

> *Probe question*: In what ways could the support you receive for assistive technology at your school be improved?
>
> *Probe question*: Do you need support more for operating the assistive technology, or for implementing the assistive technology in the curriculum?
>
> *Probe question*: How often do you request support for assistive technology?

7. How well has your previous training in assistive technology served you in the classroom?

> *Probe question*: Does lack of training limit your use of assistive technology in the classroom, and if so how?
>
> *Probe question*: What types of assistive technology training have you had?
>
> *Probe question*: What training has helped you the most?
>
> *Probe question*: What kinds of additional training would be most helpful to you?

8. Do time constraints affect your use of assistive technology?

> *Probe question*: If the reply is unclear or very brief, ask for elaboration.
>
> *Probe question*: Do time constraints come mainly from the use of the assistive technology itself, or from your other teaching responsibilities?

9. Have you increased, decreased, or discontinued your use of assistive technology during the last school year?

> *Probe question*: Whatever the teacher replies, ask for the reasons for the increase, decrease, or discontinuance.

Reference List

Albright, J. J. (2007). Confirmatory factor analysis using Amos, LISREL, and Mplus. Retrieved from http://www.indiana.edu/~statmath/stat/all/cfa/index.html

Apling, R. N., & Jones, N. L. (2007). Individuals with Disabilities Act (IDEA): Analysis of changes made by P.L. 108-446. Washington, DC: Congressional Research Service.

Baek, Y., Jung, J., & Kim, B. (2008). What makes teachers use technology in the classroom? *Computers and Education, 50*(1), 224-234.

Bender Pape, T. L., Kim, J., & Weiner, B. (2002). The shaping on individual meanings assigned to assistive technology: A review of personal factors. *Disability and Rehabilitation, 24*(1-3), 5-20.

Blackhurst, A. E. (2001). A functional approach to the delivery of assistive technology services. National Assistive Technology Research Institute. Retrieved from http://natri.uky.edu/resources/fundamentals/function.html#function

Carbone, A., Mannila, L., & Fitzgerald, S. (2007). Computer science and IT teachers' conceptions of successful and unsuccessful teaching: A phenomenographic study. *Computer Science Education, 17*(4), 275-299.

Cavanaugh, T. (2002). The need for assistive technology in educational technology. *Educational Technology Review 10*(1). Retrieved from http://www.aace.org/pubs/etr/issue2/cavanaugh.cfm

Cech, S. (2008). Tests of tech literacy still not widespread despite NCLB goals. *Education Week, 27*(2), 1-12.

Cuban, L., Kirkpatrick, H., & Peck, C. (2001). High access and low use of technologies in high school classrooms: Explaining an apparent paradox. *American Education Research Journal, 38*(4), 813-834.

Cutting-edge classroom technology is wasted on teachers. (2008). *Education, 295*, 2. Retrieved from http://www.eriding.net/resources/sis/edpub/070114_rwilliams_sis_edpub_295.pdf

Day, J. N., & Huefner, D. S. (2003). Assistive technology: Legal issues for students with disabilities and their schools. *Journal of Special Education Technology, 18*(2), 23-24.

Dunleavy, M., Dexter, S., & Heincke, W. F. (2007). What added value does a 1:1 student laptop ratio bring to technology-supported teaching and learning? *Journal of Computer Assisted Learning, 23*(5), 440-452.

Ebner, I. (2004). Abandonment of Assistive Technology. *MATR Michigans's Assistive Technology Resource*. Retrieved from http://www.florida-ese.org/atcomp/_PDF/MATR%20Abandon%20of%20Assistive%20Technology.pdf

Edyburn, D. (2003). Measuring assistive technology outcomes: Key concepts. *Journal of Special Education Technology, 18*(1), 53-55.

Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research and Development, 53*(4), 25-39.

Esposito, J. (2008). Tech success for special education. *District Administration, 44*(1), 24.

Ferguson, D. L. (2008). International trends in inclusive education: The continuing challenge to teach each one and everyone. *European Journal of Special Needs Education, 23*(2), 109-120.

Figura, K., & Jarvis, H. (2007). Computer-based materials: A study of learner autonomy and strategies. *System, 35*(4), 448-468.

Forgrave, K. E. (2002). Assistive technology: Empowering students with disabilities. *The Clearing House, 75*(3), 122-126.

Gupta, A. (2008). Education: From telos to technique? *Educational Philosophy and Theory, 40*(2), 266-276.

Henson, R. K. (2001). Understanding internal consistency reliability estimates: A conceptual primer on coefficient alpha. *Measurement and Evaluation in Counseling and Development, 34*(3), 177-189.

Hu, P. J., Clark, T. H., & Ma, W. W. (2003). Examining technology acceptance by school teachers: A longitudinal study. *Information & Management, 41*(2), 227-241.

Huberman, A., & Miles, M. (1984). *Qualitative data analysis: A source book of new methods.* Newbury Park, CA: Sage.

Inu, T. S. (1996). The virtue of qualitative and quantitative research. *Annals of Internal Medicine, 125*(9), 770-771.

Jeffs, T., Behrmann, M., & Bannan Ritland, B. (2006). Assistive technology and literacy learning: Reflections of parents and children. *Journal of Special Education Technology, 21*(1), 37-56.

Johnston, S. S. (2005). Considering response efficiency as a strategy to prevent assistive technology abandonment. *Journal of Special Education Technology, 20*(3), 45-50.

King-Sears, M. E., & Evemenova, A. S. (2007). Premises, principles, and processes for integrating technology into instruction. *Teaching Exceptional Children, 40*(1), 6-14.

Kintsch, A., & DePaula, R. (2002). *A framework for the adoption of assistive technologies.* Boulder, CO: Center for Lifelong Learning and Design.

Lahm, E. A. (2002). Factors that influence assistive technology decision making. *Journal of Special Education Technology, 17*(1), 15-26.

Lahm, E. A., Bausch, M. E., & Hasselbring, T. S. (2001). National Assistive Technology Research Institute. *Journal of Special Education Technology, 16*(3), 19-26.

Lauer, A., Longenecker Rust, K., & Smith, R. O. (2006). ATOMS Project Technical Report - Factors in Assistive Technology Device Abandonment: Replacing "Abandonment" with "Discontinuance." *ATOMS Project.* Retrieved from http://www.r2d2.uwm.edu/atoms/archive/technicalreports/tr-discontinuance.html#content.

Lee, Y., & Vega, L. (2005). Perceived knowledge, attitudes, and challenges of AT use in special education. *Journal of Special Education Technology, 20*(2), 60-63.

Liaw, S. S., Huang, H. M., & Chen, G. D. (2007). Surveying instructor and learner attitudes toward e-learning. *Computers and Education, 49*(4), 1066-1080.

Lim, C. P., & Chan, B. C. (2007). Microlessons in teacher education: Examining pre-service teachers' pedagogical beliefs. *Computers and Education, 48*(3), 474-494.

Lynch, S., & Adams, P. (2008). Developing standards-based individualized education program objectives for students with significant needs. *Teaching Exceptional Children, 40*(3), 36-39.

Ma, W. W., Andersson, R., & Streith, K. O. (2005). Examining user acceptance of computer technology: An empirical study of student teachers. *Journal of Computer Assisted Learning, 21*(6), 387-395.

Mack, N., Woodsong, C., MacQueen, K. M., Guest, G., & Namey, E. (2005). *Qualitative research methods: A data collector's field guide.* Research Triangle Park, NC: Family Health International. Retrieved from http://www.fhi.org.

Mansmann, S., & Scholl, M. H. (2007). Decision support system for managing educational capacity utilization. *IEEE Transactions on Education, 50*(2), 143-150.

McGee, P., & Diaz, V. (2007). Wikis and podcasts and blogs, oh my! What is a faculty member supposed to do? *Educause Review, 42*(5), 28-40.

McNaughton, D., Rackensperger, T., Benedek-Wood, E., Krezman, C., Williams, M. B., & Light, J. (2008). "A child needs to be given a chance to succeed": Parents of individuals who use AAC describe the benefits and challenges of learning AAC technologies. *Augmentative and Alternative Communication, 24*(1), 43-55.

Meeks, G. (2007). IP-based technology has its negative tradeoffs. *School Planning and Management, 46*(10), 19.

Miller, S., Adsit, K. I., & Miller, T. (2005). Evaluating the importance of common components in school-based websites: Frequency of appearance and stakeholders' judged values. *Tech Trends, 49*(6), 34-40.

Muthén, L.K. and Muthén, B.O. (2007). *Mplus user's guide* (4th ed.). Los Angeles, CA: Muthén & Muthén. Retrieved from http://www. statmodel.com/download/usersguide/Mplus%20Users%20Guide%20v41.pdf

National Center for Learning Disabilities. (2007). The Individuals with Disabilities Education Act, 2004. Retrieved from www.ncld.org/content/view/274/321/

Netherton, D. L., & Deal, W. F., III. (2006). Assistive technology in the classroom. *The Technology Teacher, 66*(1), 10-15.

Osborne, A. G., Jr. (2004). Students with disabilities. *The Yearbook of Education Law*, 103-138.

Ozel, S., Ebrar Yetkiner, Z., & Capraro, R. M. (2008). Technology in K-12 mathematics classrooms. *School Science and Mathematics, 108*(2), 80-85.

Patton, M. Q. (1980). *Qualitative evaluation methods.* Beverly Hills, CA: Sage.

Peck, A. F., & Scarpati, S. (2006). Using high and low technology to help our students. *Teaching Exceptional Children, 38*(6), 4.

Phillips, B., & Zhao, H. (1993). Predictors of assistive technology abandonment. *Assistive Technology, 5*(1), 36-45.

Poel, E. W. (2007). Enhancing what students can do. *Educational Leadership, 64*(5), 64-66.

Reed, B. J. (1995). Empowerment and assistive technology: The local resource team model. *Journal of Rehabilitation, 61*, 30-35.

Reed, P. (1999). Assistive technology and the IDEA. *The Exceptional Parent, 29*(11), 54-55, 57-58.

Roach, A. T., & Frank, J. L. (2007). Large-scale assessment, rationality, and scientific management: The case of No Child Left Behind. *Journal of Applied School Psychology, 23*(2), 7-25.

Rotter, J. (2006). Locus of control. *In Light Times,* December. Retrieved from http://www.inlightimes.com/archives/2006/12/locus-control.htm

Russell, M., Bebell, D., O'Dwyer, L., & O'Connor, K. (2003). Examining teacher technology use: Implications for preservice and in-service teacher preparation. *Journal of Teacher Education, 54*(4), 297-310.

Smarkola, C. (2008). Efficacy of a planned behavior model: Beliefs that contribute to computer usage intentions of student teachers and experienced teachers. *Computers in Human Behavior, 24*(3), 1196-1215.

Smith, D. W., & Kelley, P. (2007). A survey of assistive technology and teacher preparation programs for individuals with visual impairments. *Journal of Visual Impairment and Blindness, 101*(7), 429-433.

Stodden, R. A., & Roberts, K. D. (2005). The use of voice recognition software as a compensatory strategy for postsecondary education students receiving services under the category of learning disabled. *Journal of Vocational Rehabilitation, 22*(1), 49-64.

Stodden, R. A., Roberts, K. D., Picklesimer, T., Jackson, D., & Chuan, C. (2006). An analysis of assistive technology supports and services offered in postsecondary educational institutions. *Journal of Vocational Rehabilitation, 24*(2), 111-120.

Telem, M., & Pinto, S. (2006). Information technology's impact on school-parents and parents-student interrelations: A case study. *Computers and Education, 47*(3), 260-279.

Temple, Cheryl L. (2006) Successes and barriers: Teachers' perspectives on implementing assistive technology in educational settings. (Doctoral dissertation, George Mason University, 1990). Retrieved from Dissertations & Theses: Full Text database. (Publication No. AAT 3208965).

The Georgia Department of Education. (2008). *Job Announcement*. Retrieved from http://www.doe.k12.ga.us/pea_hr_jobsearch.aspx?jobid=592.

The Georgia Project for Assistive Technology. (2003). The legal mandate for providing assistive technology. Retrieved from http://www.gpat.org/Resources%20Main.htm

Underwood, J., Smith, H., Luckin, R., & Fitzpatrick, G. (2008). E-science in the classroom: Towards viability. *Computers and Education, 50*(2), 535-546.

U.S. Department of Education. (2004). *IDEA*. Retrieved from www.ed.gov/offices/OSERS/IDEA.

U.S. Department of Education. (n.d.). *Disability discrimination: Overview of the laws*. Retrieved from http://www.ed.gov/policy/rights/guid/ocr/disabilityoverview.html

Verza, R., Carvalho, M. L., Lopez, M., Battaglia, M. A., & Uccelli, M. (2006). An interdisciplinary approach to evaluating the need for assistive technology reduces equipment abandonment. *Multiple Sclerosis, 12*(1), 88-93.

Wessels, R., Dijcks, B., Soede, M., Gelderblom, G. J., & De Witte, L. (2003). Non-use of provided assistive technology devices: A literature overview. *Technology and Disability, 15*(4), 231-238.

Zhao, Y., & Cziko, G. A. (2001). Teacher adoption of technology: a perceptual control theory perspective. *Journal of Technology and Teacher Education, 9*(1), 5-30.

Zhao, Y., Pugh, K., Sheldon, S., & Byers, J. L. (2002). Conditions for classroom technology innovations. *The Teachers College Record, 104*(3), 482-515.