WILLIAMSON-HENRIQUES, KENDRA M., Ph.D. Secondary Teachers' Perceptions of Assistive Technology Use for Students with Learning Disabilities. (2013)
Directed by Drs. William D. Bursuck and Stephanie Kurtts. 170 pp.

The purpose of this study was to examine secondary general education teachers' perspective of assistive technology use for students with disabilities. A total of four secondary schools participated in this study. Within these schools, 110 general education teachers completed surveys. The survey included three subscales: usage of assistive technology, attitudes and beliefs about assistive technology, and supports and barriers associated with assistive technology. There was one open-ended question that allowed participants to include their thoughts concerning assistive technology. Additional data were collected through interviews and focus groups. Twelve general education teachers participated in two focus groups (one middle school level and one high school level) and four special education teachers as well as four principals completed an interview.

The majority of participants was female, held a bachelor's degree, and had less than five years of teaching experience. The data revealed that teachers understood the importance of using assistive technology but felt unprepared to effectively use devices because of lack of a lack of resources, limited planning time, adequate technical support, disjointed professional development, uncertainty of how to use assistive technology within their content area, and poor infrastructure. The implications of these findings for practice and future research are discussed.

SECONDARY TEACHERS' PERCEPTIONS OF ASSISTIVE TECHNOLOGY USE FOR STUDENTS WITH LEARNING DISABILITIES

by

Kendra M. Williamson-Henriques

A Dissertation Submitted to
the Faculty of The Graduate School at
The University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

Greensboro
2013

Approved by

Dr. William D. Bursuck
Committee Co-Chair

Dr. Stephanie Kurtts
Committee Co-Chair

Dedicated to:

My husband, Tchijica, for his love, encouragement, and unwavering support.

My parents, Marvin Williamson Sr. and Joyce M. Ray for their love, prayers, and guidance.

My brother, Marvin Williamson Jr. (Bro-Bro) for reminding me to do it big.

Uncle James Marshall, Aunt Frances, and my cousins Anjel and Lecia for providing a home away from home every summer that was filled with love, fun, and learning.

Aunt Hokey and her dissertation in the backseat (Ashley) for encouraging me to finish.

Aunt Shirley, for being a great example of a teacher.

My awesome extended family and friends who have cheered me on during this journey. I am thankful for your dedication and love.

APPROVAL PAGE

This dissertation, written by Kendra M. Williamson-Henriques, has been approved by the following committee of the Faculty of The Graduate School at The University of North Carolina at Greensboro.

Committee Co-Chairs Dr. William D. Bursuck

Dr. Stephanie Kurtts

Committee Members Dr. Nicole Dobbins

Dr. Misti Williams

_____

Date of Acceptance by Committee

_____

Date of Final Oral Examination

ACKNOWLEDGMENTS

Over a decade ago, I received a prophetic word that would change my life in ways I could never imagine. Mercedes Benjamin, a Pastor unknown to me, was leading prayer during a revival. Pastor Benjamin paused, looked into the crowd, and singled me out by saying, "young lady with the white suit please come forward." Pastor Benjamin spoke boldly declaring I would receive many degrees. After hearing God's word, I fell to the floor. At the time I was a freshman in college, but those words remained with me. Now that I have completed two bachelor degrees, a master's degree, a national teaching certification, and a doctorate degree, I stand before my family and friends to proclaim the word of God is true! As I reflect on this accomplishment, I know Jesus opened doors and gave me the strength to make it through. I am thankful for His mercy, His grace, and the people He placed in my path along this journey.

Without support and love from my family, I would have suffered in silence and rejoiced alone. Tchijica, I am thankful that you were able to provide for our family financially, so that I could stay home and write the first four chapters of my dissertation. Without this selfless deed it would have taken more time for me to meet this goal. I would also like to thank my mama for knowing exactly what to say to motivate me to finish. I appreciate all that you have done to provide me with new experiences and encouraging me to strive for excellence. Mommy, above all, I thank you for praying for me when I was too sad or frustrated to pray for myself. Dad, thank you for sharing your

wisdom with me. You were always prepared with life lessons that provided guidance, kindness, and love.

Finally, I would like to express gratitude to my committee. Navigating the doctoral process is not an easy task, but having a well-balanced committee provides an awesome support system. Dr. Dobbins, your advice was hard to accept at times, but now that my career has started I will continue to wear your advice (smile); Dr. Williams, your mentorship in my early teaching career, wisdom, and enthusiasm for learning gave me a resolute passion to continue my education; and to my wonderful co-chairs, Dr. Kurtts, thank you for reminding me that my dissertation is not my life's work, but the start of my career; Dr. Bursuck, I am grateful for your insightful and constructive feedback on my dissertation. It is a great honor to have each of you on my doctoral committee and a testament to the power of encouragement.

TABLE OF CONTENTS

Page

LIST OF TABLES ix

LIST OF FIGURES x

CHAPTER

I. INTRODUCTION TO THE STUDY 1

Background 1
Assistive Technology 3
Conceptual Framework for the Study 7
Multiple Means of Representation 9
Multiple Means of Action and Expression 9
Multiple Means of Engagement 10
The Complementary Nature of UDL and AT 11
Statement of the Problem 14
Purpose of the Study 15
Research Questions 17
Limitations and Assumptions 18
Limitations 18
Definition of Key Terms 19
Summary 20

II. LITERATURE REVIEW 22

Introduction 22
Academic and Social Needs of Students with Disabilities 23
Learning Disabilities 24
Learning Disability in Reading 24
Demands of Secondary Classes 25
Academic Concerns for Students with Learning Disabilities 26
Social and Emotional Concerns 28
Promoting Access to the General Curriculum 30
Universal Design Networks and Assistive Technology 30
Assistive Technology Effectiveness Research 32
Barriers to Technology Integration in Schools 37
Teacher-level Barriers 38

School-level Barriers 48
Summary 51

III. RESEARCH DESIGN AND METHODOLOGY 52

Introduction 52
Population and Sample 54
Instrumentation 55
Self-administered Survey 56
Semi-structured Interviews 57
Focus Groups 58
Data Collection 59
Survey 59
Focus Groups 60
Interviews 60
Data Analysis 61
Quantitative Analysis 61
Qualitative Analysis 62
Summary 63

IV. RESULTS 64

Results of the Pilot Study and Participants 65
Results of the Pilot Study 65
Participants 66
Demographics 66
Quantitative Results 69
Subscale 1: Usage of Assistive Technology (UAT) 69
Subscale 2: Teacher Attitudes and Beliefs about Assistive Technology (TAB) 74
Subscale 3: Supports and Barriers to Assistive Technology (SAB) 76
Qualitative Results 79
Survey Open-ended Question 80
Face-to-Face Interviews 81
Focus Groups 90
Chapter Summary 99

V. DISCUSSION 101

Summary of Findings 104
Research Question 1 104
Research Question 2 107

Research Question 3 108
Research Question 4 111
Discussion 112
Existing Knowledge 113
Self-efficacy 114
Pedagogical Beliefs 114
Implications for Practice 116
Teacher Education Programs 116
Professional Practice 117
Recommendations for Future Research 119
Conclusion 121

REFERENCES 123

APPENDIX A. SECONDARY TEACHERS' PERCEPTIONS OF ASSISTIVE TECHNOLOGY USE WITH STUDENTS WITH LEARNING DISABILITIES SURVEY 153

APPENDIX B. FOCUS GROUP PROCEDURE/QUESTIONS 162

APPENDIX C. SEMI-STRUCTURED INTERVIEW PROCEDURE/ QUESTIONS 164

APPENDIX D. IRB APPROVAL NOTICE 170

LIST OF TABLES

Page

Table 1. Research Question Matrix and Data Sources....63

Table 2. Gender, Education, Years of Experience, and Current School Year Classes....67

Table 3. Teacher Certification....68

Table 4. Number of Responses, Percentage Distribution, Means, and Standard Deviations for Usage of Assistive Technology Subscale (*N* = 110)....70

Table 5. Group Comparisons and Independent *t*-test for Usage of Assistive Technology Subscale....71

Table 6. Response to Survey Item 13 (*N* = 110)....72

Table 7. Number of Responses, Percentage Distribution, Means, and Standard Deviations for Teacher Attitudes and Beliefs about Assistive Technology Subscale (*N* = 110)....75

Table 8. Group Comparisons and Independent *t*-test for Usage of Assistive Technology Subscale....76

Table 9. Number of Responses, Percentage Distribution, Means, and Standard Deviations for Supports and Barriers to Assistive Technology Subscale (*N* = 110)....78

Table 10. Teacher Training for AT....79

Table 11. Themes for Interview Questions....82

Table 12. Themes for Focus Group Questions....95

LIST OF FIGURES

Page

Figure 1. The relationship between AT and UDL 12

Figure 2. Implementation of action research flowchart 118

CHAPTER I

INRODUCTION TO THE STUDY

Background

As society's understanding of disabilities has evolved so have the educational opportunities for students with learning disabilities (LDs). However, many educators working in today's secondary schools are aware of the lack of proficiency in math, reading, and science in far too many of their students, especially those with learning disabilities. Approximately half of the 6.7 million students served under the Individual with Disabilities Education Improvement Act (IDEIA) have learning disabilities (Messinger-Willman & Marino, 2010). With the ever-increasing population of students with LD in general education classes (Snyder, 2008) federal law requires that schools include these students in academic and social settings with nondisabled peers. Additionally, this mandate holds schools accountable for making sure those students with LD participate in state testing and are included in the data of adequate yearly progress (AYP; No Child Left Behind Act, 2001). Unfortunately, a number of students with learning disabilities have difficulties attaining passing scores (Messinger-Willman & Marino, 2010) and meeting goals set in their individualized education programs (IEPs). For example, in 2005 the National Assessment of Educational Progress indicated that reading scores for secondary students with disabilities were below the proficient level compared to nondisabled peers (as cited in M. L. Harris, Schumaker, & Deshler, 2011).

Although there are no shortcuts to accelerate the academic performance of struggling older students, it is possible to close the achievement gap by providing these learners with access to assistive technology (AT) in a universally designed academic setting (D. H. Rose, Hasselbring, Stahl, & Zabala, 2005).

Significant cultural, educational, and legal changes have changed the ratio of students in general educations classes (Meyer & Rose, 2002). Today's general education classroom might include students who are second language learners, are below grade level, have emotional or attention problems, or who are cognitively or physically disabled or gifted. With this shift, teachers are moving toward more flexible teaching methods and materials that will help students achieve high standards by maximizing learning opportunities for all learners (D. H. Rose, Hasselbring, et al., 2005). Universal Design for Learning (UDL) is a flexible teaching approach that provides an opportunity for teachers to create class-wide learning goals, customized support, and assessments that measure ongoing progress to directly meet the challenges of individual differences (Messinger-Willman & Marino, 2010). Additionally, UDL capitalizes on the rapid evolution of technology to create systematic and effective instructional practices and materials that provide students with choices of differentiated learning methods (D. Rose & Meyer, 2000a). Over past decades, technology has revolutionized the ways teachers instruct students. Incorporating appropriate technology in general education classrooms can help to keep students with disabilities involved in learning. Technology, along with UDL has had a distinct role in improving educational outcomes for students with disabilities (D. H. Rose, Hasselbring, et al., 2005). Before addressing these roles, it is

important to distinguish the difference between computer assisted instruction (CAI) and AT because although these two approaches both involve learning using computer technology, the terms are not interchangeable.

It is important that teachers recognize that there are different types of educational computer use, but not every use of a computer in the classroom is considered computer-assisted instruction. For instance, assistive technology includes the use of computers or software; however, it also refers to a number of other types of accommodations and adaptations which enable individuals with disabilities to function more independently. Computers are an important type of assistive technology because they provide many possibilities for reading, writing, speaking, finding information, or controlling an individual's environment. Computers are common fixtures in classrooms, making technology a streamlined approach for many educational tasks. With this understanding it is important to note that any computer-assisted instruction mentioned in this study meets the guidelines for assistive technology.

Assistive Technology

Over the past three decades, special education has addressed assistive technology resources and services (Alpher & Raharinirina, 2006; Edyburn, 2000; H. Lee & Templeton, 2008). The origin of this progression is due to several federal laws that promote accessibility for individuals with disabilities. In 1973, federal legislation ensured that students with disabilities received basic civil rights by mandating access to buildings, services, and instruction through Section 504 of the Rehabilitation Act. For children, these rights were expanded with the Education for all Handicapped Children

Act of 1975, today reauthorized as the Individuals with Disabilities Education Improvement Act IDEIA of 2004. Within the 2004 revision of IDEIA, guidelines are outlined for school districts to provide AT services and devices for students who are eligible for special education services. Additionally, the Technology Related Assistance for Individuals with Disabilities Act of 1988 (Tech Act) had an impact on providing necessary AT to individuals with disabilities by defining it as a device and a service. This law was passed to provide funding to support assistive technology development, dissemination of information, and training programs on assistive technology for individuals with disabilities. In 1998, the Assistive Technology Act replaced the original Tech Act. This reauthorization shifted from the process of AT devices and services, to providing access to the general education curriculum for student with disabilities (Tech Act, 1988).

Since school districts are required by law to provide appropriate assistive technology to eligible students with LD to support the acquisition of Free and Appropriate Public Education (FAPE), it is necessary for teachers to understand the what, who, and how concerning assistive technology. The commonly accepted definition of assistive technology comes from P.L. 100-407: The Technology Related Assistance for Individuals with Disabilities Act of 1988, which was slightly adapted and became the definition in the 1997 Reauthorization of Individuals with Disability Act (IDEA). It defines assistive technology 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 functional capabilities of a child with a disability” (IDEA,

1997, p. 8). Assistive technology devices can range from *low tech* (e.g., pencil grips, highlighters, and color overlays) to *high tech* (e.g., text-to-speech software, computers, and braille readers). Also included are environmental controls such as pointer sticks, mobility devices such as wheelchairs, and adapted equipment such as bath chairs or toys (Alpher & Raharinirina, 2006). Assistive technology also can be defined as a service, which includes support that directly assists an individual with a disability in the evaluation, selection, purchase, or use of an assistive technology device (IDEA, 1997). This definition includes a broad range of low-tech and high-tech devices that individuals could use in an educational setting toward the purpose of inclusion (Lahm & Sizemore, 2002; H. P. Parette & Stoner, 2008).

Assistive technology is designed to create a user-friendly environment for students who receive special education services and has the ability to maximize students' academic success. Furthermore, AT can be used to increase equitable access to academic, social, and extracurricular activities for students with learning disabilities (Dyal, Carpenter, & Wright, 2009). However, research demonstrates that AT is less likely to be used by students with high-incidence disabilities, such as learning disabilities (National Assistive Technology Research Institute, 2005; Quinn, Behrmann, Mastriopieri, & Chung, 2009), and is less often used in general classrooms than in special education classrooms (Hasselbring & Bausch, 2006). The National Reading Panel (2001) recognizes AT as a promising practice in regard to inclusion for students with disabilities therefore educators should understand the potential outcomes associated with the use of these devices.

Moreover, assistive technology is considered to be compensatory because the devices can be used to enhance the ability of a person who has an intellectual or a physical disability to independently do or perform a task at the expected level (Dyal et al., 2009; Kara-Soteriou, 2009). Hasselbring and Glaser (2000) note that assistive technology "can enable even those students with severe disabilities to become active learners in the classroom alongside their peers who do not have disabilities" (p. 102). This has led to increased opportunities for students with learning disabilities to use assistive technology in educational environments (Copley & Ziviani, 2004). Increasingly, incorporating appropriate AT in general education classrooms can maintain students with LD involvement in learning (D. P. Bryant & Bryant, 2003), keep students from focusing on the disability (Quenneville, 2001), as well as help them establish connections in and out of the classroom (Scherer, 2004).

In recent years, the field of assistive technology has expanded to include high-tech devices such as computers and accompanying software. Such high-tech devices have enabled students with physical disabilities such as cerebral palsy, multiple sclerosis, visual impairments, and blindness to utilize personal computers for everyday living and academic settings. Likewise, assistive technology facilitates students who have cognitive disabilities to compensate for specific deficits (A. Cook & Hussey, 2002). Although assistive technology has potential benefits for all students, it has a greater potential for students with learning disabilities (Campbell, 2009; Edyburn, 2006; Maccini, Gagnon, & Hughes, 2002). For example, portable math processors, virtual manipulatives, or electronic math processing software may aid a child with a learning disability to learn

math facts more rapidly, focus on planning and revising written work, and enhance the ability to decipher and comprehend text (Glazer, 2004; C. MacArthur, 2009; Marino, 2009).

Conceptual Framework for the Study

Traditionally, the "one size fits all" standard is a characteristic of general education classrooms. When this occurs students with disabilities encounter barriers that prevent them from accessing the curriculum (D. Rose & Meyer, 2000a). In the early 1990s the Universal Design for Learning (UDL) framework was created by staff at the Center for Applied Special Technology (CAST), the Council for Exceptional Children, and others (Pisha & Coyne, 2001) to create a successful learning environment that would support and challenge students while minimizing barriers. UDL is a relatively new framework that has emerged over the last two decades (Messinger-Willman & Marino, 2010) and presents teaching approaches for support and learning differences as well as providing students with a wider variety of options (Meyer & Rose, 2002). Universal Design for Learning is an extension of an architectural movement called *universal design* (UD) which was created in by Ron Mace at North Carolina State University (Meyer & Rose, 2002). The primary purpose for UD was to create structures to accommodate a wide range of users including those with disabilities, and eliminate the need for additional adaptation or specialized design (Meyer & Rose, 2002). In order to create this environment, architects used seven principles to remove barriers in the environment: equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, and size and space for approach and use (M.

King-Sears, 2009). UDL mirrors UD by providing access; however, the access provided by UDL extends not only to the environment but to curriculum development.

Typically, when educators hear the words universal design for learning they associate it with technology (Zascavage & Winterman, 2009). However, UDL does not exclusively focus on technology in education, but also includes pedagogy, or instructional practices, used for all students (M. E. King-Sears, 2001; D. Rose & Meyer, 2000b). The UDL framework is an extension of Lev Vygotsky's work (1978) as well as new advances in brain research in the area of learning and processing information (D. Rose & Meyer, 2006). Vygotsky makes the case that learning is made up of recognition of new information, ways to process that information, and engagement in the learning task (as cited in D. Rose & Meyer, 2006). Brain imaging research conducted while individuals were performing learning tasks in reading and writing indicated recognition networks, strategic networks, and effective networks as three separate neural networks performing in the learning brain (Meyer & Rose, 2002). In accordance with Vygotsky's theory of development of higher mental process and the findings from neuroscience scientists, the researchers at CAST created the framework for UDL which divides the curriculum into three networks: (a) recognition network (i.e., What am I learning?) through multiple, flexible methods of presentation; (b) strategic network (i.e., How will I learn?) through multiple, flexible methods of expression; and (c) effective network (i.e., Why should I learn this?) by providing multiple, flexible methods of representation (D. Rose, Meyer, & Hitchcock, 2005). Within these networks researchers at CAST created the following three guiding principles for developing curricula which helps to minimize

barriers in learning, builds on the strengths of the student, and allows multiple ways for students to succeed. These principles focus on the need to include

1. diverse recognition networks and provide multiple means of representation,
2. diverse strategic networks and provide multiple means of action and expression, and
3. diverse affective networks and provide multiple means of engagement.

Multiple Means of Representation

Recognition networks enable a learner to collect facts and information that support the "what" of learning (D. Rose, Meyer, et al., 2005). When a learner is able to recognize information, the way in which the learner processes this information can vary. Because of this teachers should offer multiple means of representation which could include a variety of formats and opportunities to acquire the information necessary to succeed in class. For example, if a student has difficulty with multiplication the teacher may present multiplication facts by using a diagram such as an array or using repeated addition to represent the multiplication problem.

Multiple Means of Action and Expression

Strategic networks help the individual plan and perform a task; this represents the "how" of learning (D. Rose, Meyer, et al., 2005). Being able to solve equations or compose a report requires the learner to think strategically. Offering students multiple means of action or expression enables them to demonstrate what they have learned. To illustrate, a teacher may provide graphic organizers to help students understand the elements of a story such as the beginning, middle, and the end.

Multiple Means of Engagement

Affective networks support motivation and interest of a student working on a task, which represents the "why" of learning (D. Rose, Meyer, et al., 2005). Allowing students to have meaningful experiences during learning promotes engagement. By offering multiple means of engagement students have a choice in their participation of the learning activity. For instance, providing students with a choice board creates a flexible curriculum for the learner.

Universal design is a process that includes general products or structures that can be used by students with or without disabilities (Evans, Williams, King, & Metcalf, 2010). However, UDL represents a shift in how teachers look at learner differences as well as how to differentiate instruction. According to D. Rose and Meyer (2006), UDL "provides a framework for setting clear learning goals, selecting and applying flexible materials, providing instruction that challenges and supports each learner, and assessing each learner's progress more accurately" (p. 2). By using UDL, emphasis is placed on adapting a curriculum for student needs rather than requiring the learner to adapt to the curriculum (D. Rose & Meyer, 2006). For example, Wiggle Works was the first universally designed curriculum that removed the barrier of print-based textbooks which excluded many general education students as well as those with physical, visual, and learning disabilities. The Wiggle Works program is a multimedia literacy program with built-in options which make it more flexible than printed text. This program was developed with features that allow all students, including those with disabilities to use features such as large text, text read aloud, and help button for students who experienced

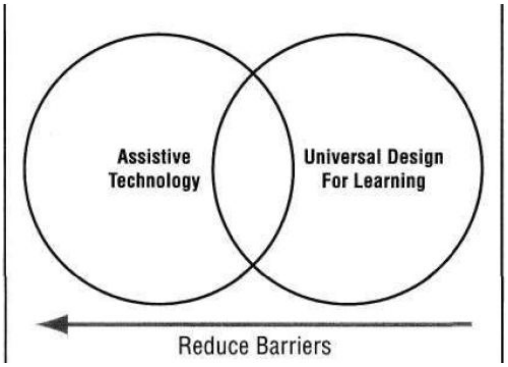
difficulty with the coding printed text (D. Rose & Meyer, 2006). In addition to these features, the Wiggle Works program includes a management system that allows teachers and parents to select books specific to the learners' needs and preferences.

Classrooms that include UDL must address multiple means of representation, expression, and engagement while considering individual preferences whenever feasible (Hitchcock & Stahl, 2003). Meyer and Rose (1998) point out those students who struggle to learn are insecure, anticipate failure, and have low engagement during the learning activity. By using UDL, learners have opportunities to choose from a wide range of instructional approaches. Furthermore, UDL should provide leveled materials and technology that support and challenge students as well as provide materials that maximize each student's chance to be successful (Silver-Pacuilla, 2006).

The Complementary Nature of UDL and AT

UDL is referred to by CAST (2011) as a *blueprint* for creating flexible and customizable instructional goals, strategies, learning materials, and assessments that work for all students. Since students vary in needs, skills, and interests it is important to take a look at how UDL and AT can be combined to harmonize inclusive practices. AT is designed to focus on an individual student's need, while UDL focuses on making learning more accessible to the widest range of students (M. King-Sears, 2009; Messinger-Willman & Marino, 2010). Furthermore, UDL seeks to educate curriculum developers, teachers, and administrators on making the best curricula and learning environment for all students (Evans et al., 2010). When AT and UDL are integrated it creates more accommodating learning and flexibility for all users. Assistive Technology

is a vital part of UDL (Edyburn, 2010; D. H. Rose, Hasselbring, et al., 2005; Zascavage & Winterman, 2009). According to Messinger-Willman and Marino (2010), the two work together and separate of one another to help break down the barriers of learning for all students. Consider an example where a language arts teacher has a student who struggles with written expression in her class. When she views the student's learning difficulty from the standpoint of AT, she considers how speech-to-text software can help that student complete the writing task. If you take the same student and look through the lens of UDL, the teacher understands that a learning barrier within the curriculum prohibits the students from manually writing or typing responses. The teacher can alter the assignment so that barrier no longer exists for this student and other students by allowing all students to have the option of using the text to speech software to compose their work.



Source: D. H. Rose, Hasselbring, et al. (2005)

Figure 1. The relationship between AT and UDL.

Both AT and UDL are designed to promote access, participation, and student progress (Hitchcock & Stahl, 2003); therefore it is reasonable to combine the attributes of

each and apply them to inclusive practice. IDEA 2004 mandates IEP teams to consider universal design principles when developing or reviewing students' IEPs. Likewise, educational mandates state that IEP teams consider assistive technology for all students with disabilities. The abovementioned networks and principles in UDL can help to establish educational support for students with LD in conjunction with assistive technology by helping teachers recognize learning barriers and incorporate assistive technology to promote access (Messinger-Willman & Marino, 2010).

With the rise of new media learning tools and assistive technology teachers and students are presented with numerous options for interacting with, displaying, and viewing information in non-textual form (Pisha & Coyne, 2001). These new networking technologies offer exciting opportunities for learning. Combining UDL and these learning tools and AT can create a new generation of flexible curricula and materials that accommodate each student's strengths, weaknesses, interests, and background knowledge (Zascavage & Winterman, 2009). Although AT devices offer effective possibilities for improving students' learning, particularly students with LD, the teacher makes the difference concerning the integration of assistive technology into the learning process (Heinich, Molenda, Russell, & Smaldino, 1999). In order to provide high-quality instruction for students with learning disabilities, it is important that teachers be well versed in the application and selection of assistive technology as well as how to plan a flexible curriculum to implement these devices (Pisha & Coyne, 2001). As schools seek to align their assistive technology resources in a manner that allows for more flexibility

and differentiation within the curriculum, research is necessary that examines secondary teachers' ability and/or desire to use it in their classrooms.

Statement of the Problem

The increased numbers of students with disabilities in secondary general classrooms present complex challenges for teachers such as demands of inclusion, accountability, and changes in instructional practices (W. Johnson, 2008; Scheeler, Congdon, & Stansbery, 2010; Simpson, McBride, Spencer, Lowerdmilk, & Lynch, 2009; Voltz & Collins, 2010). Additionally, integrating assistive technologies into their curriculum is an issue for some teachers because of (a) apprehension when using unfamiliar technology, (b) a lack of training, (c) the absence of onsite support, and (d) teacher beliefs (Barfurth & Michaud, 2008; Brinkerhoff, 2006; C. H. Chen, 2008; H. P. Parette & Stoner, 2008). Because technology may be overwhelming for teachers, they may rely on traditional supplemental activities such as review worksheets, flashcards, or other remedial activities for struggling students instead (Edyburn, 2003a; White, Wepner, & Wetzel, 2003). For example, a two-year study reported by Hutinger, Johanson, and Stoneburner (1996) observed several situations in which a student's progress either plateaued or regressed, depending on the teacher's attitude towards AT. For example, one student could no longer use his communication device after changing classes because the teacher felt that it would take too much of her time to learn to program the device. Hutinger et al. (1996) suggested that some teachers had no desire to learn to use AT or did not believe that technology could help their students. Further, failure to use assistive technology in inclusive settings may also be due to insufficient planning. To illustrate, in

a study of 14 children conducted over a two-year period, ongoing reassessment of AT needs did not occur unless initiated by an agency external to the school (Hutinger et al., 1996). This suggests that long-term planning and review of students' AT needs is not a feature in many school programs, a feature that limits the effectiveness of technology programs. Such findings may explain at least in part the current learning gap in inclusive classrooms between students with disabilities and their non-disabled peers. In terms of removing barriers associated with assistive technology, and minimizing the achievement gap, teacher involvement is essential.

In essence, instructional modifications using assistive technology in a universally designed framework can promote access, participation, and progress for students with disabilities (Silver-Pacuilla, 2006), as well as create flexible instruction, engagement, and assessment options that reduce barriers at the onset of the learning process (Messinger-Willman & Marino, 2010). Despite the increase of assistive technologies, limited research has been conducted on the perceptions of general education secondary teachers as to its use in their classrooms.

Purpose of the Study

In public schools today, the vast majority of secondary classrooms' accommodations for students with LD are administered by general education teachers (Clark, Sang Min, Goodman, & Yacco, 2008). While general education teachers are experts in a particular content, many have minimal training in special education (Wasta, 2006). Although special education teachers work closely with general educators to provide assistance and knowledge, they are not in the general education classroom to

oversee the implementation of accommodations such as AT (Smith & O'Brien, 2007). As a result, the implementation of AT accommodations for students with LD is neglected (Hasselbring & Bausch, 2006; Mattson & Roll-Pettersson, 2007). Thus, focusing on teachers' perceptions of technology is important for understanding what needs to be done to better support the use of AT in inclusive classrooms if we are to ever minimize the learning gap between students with disabilities and their non-disabled peers (Buehl & Fives, 2009; F. H. Chen, Looi, & Chen, 2009). Indeed, a number of studies on teacher perceptions of technology use have verified that teacher perceptions have an impact on the teachers' use of technology in the classroom (F. H. Chen et al., 2009; Ertmer & Ottenbreit-Leftwich, 2010; John, 2005; Yuen & Ma, 2008). Furthermore, Zhao and Cziko (2001) state that in order for teachers to effectively use technology, they must believe that (a) technology can help them to achieve higher-level goals more effectively, (b) technology use will not disturb higher level goals, and (c) the teachers will have adequate ability and sufficient resources to use technology. Teachers' perceptions serve as a filter through which they determine the priorities and degree to which technology will be integrated into a classroom (Zhao & Frank, 2003).

In spite of increasing access to technology, the frequency and extent to which general education teachers utilize AT within their classrooms are unknown. The purpose of this study is to examine secondary teachers' perception of assistive technology use within inclusive classrooms. The research on secondary teacher's perceptions of assistive technology for students with LD is significant for two reasons. First, research in this area will enhance current literature in the area of how secondary general educators perceive

the purpose of implementing AT for their students with LD. Secondly; this research aims to identify secondary teachers' beliefs about how skills and knowledge of AT can benefit teachers and students with LD.

Research Questions

A survey, interviews, and focus groups were designed to answer the following four research questions:

1. What are the experiences of general education teachers regarding the selection and implementation of AT devices in inclusive settings?

    Subquestion 1: Is there a significant mean difference of usage of AT between general education teachers who have taught fewer than 5years and teachers who have taught more than10 years?

    Subquestion 2: To what extent are general education teachers using AT for reading, writing, mathematics, listening, and organization/memory?

2. How do general education teachers perceive the use of Assistive Technology by students with LD?

    Sub question1: What is the relationship between the number of years teaching inclusion classes and teacher perceptions of AT for students with LD?

    Sub-question 2: Is there a significant mean difference of AT usage for students with LD between math and English teachers?

3. What knowledge and skills do general education teachers perceive would facilitate their use of assistive technology in inclusive settings?

    Subquestion 1: What are the factors that influence teachers knowledge and skills of AT?

    Subquestion 2: What is the relationship between years of experience using AT and knowledge and skills amongst general education teachers?

4. What do general education teachers perceive as constraints that affect assistive technology implementation?

    Subquestion 1: What are the factors that influence AT use in general education classrooms?

Limitations and Assumptions

Limitations

Limitations of this study include the assumptions that general education teachers honestly answer survey questions, openly share their experiences as teachers working in inclusive classrooms during the focus group, and understand the terms, accommodations and assistive technology. This study was also limited by the selection of participants because the school district only had two middle schools and one high school, making the sample size small and the ability to discern broad themes more difficult. This study's specific goal was to examine general education teachers' perceptions of assistive technology in inclusive classes. The study represents the perceptions of the general education teachers at the time of the research study. These perceptions could have

changed after data collection—with the addition of new students or new leadership within the school. The research study was also limited to a rural area within the southwestern geographic area of the United States. The quality of this study could have been improved through a participant sampling across a larger geographical area in the United States.

Definition of Key Terms

Terms directly related to the current research are defined in this section and will be used throughout this study.

Accommodation refers to a change in course, standard, test preparation, location, timing, scheduling, expectations, student response, and/or other attribute. This change provides access for a student with a disability to participate in a course, standard or test, but fundamentally does not alter or lower the course, standard, or test (Edgemon, Jablonski, & Lloyd, 2006).

Assistive/Adaptive Technology—Any item, equipment or product system either acquired commercially, off the shelf, modified, or customized and utilized to increase, maintain, or improve functional capability for an individual with disabilities (P.L. No. 100-407, 1988).

Assistive Technology Service—any service that directly assists an individual with a disability in the selection, acquisition, or use of an assistive technology device (P.L. No. 100-407, 1988).

General Curriculum—Standards that are intended to serve as guidelines for teachers to develop instruction. Additionally, this same curriculum is created to provide

equitable standards, ensuring that all students pursue a similarly high level of skill (Kutepova, 2011).

High- tech Device—A high-tech device is usually a complex expensive electronic or mechanical piece of equipment (King, 1999).

Inclusion—A belief system held by school professionals that all students are effectively educated in a learning environment that is least restrictive and each child is held to high expectations (Friend & Shamberger, 2008).

Learning disability—A disorder that affects the ability of the individual to understand or use spoken or written language; can be identified by difficulties with listening, thinking, speaking, reading, writing, spelling, or mathematical calculations (Wright & Wright, 2009).

Low-tech Device—A low-tech assistive technology device is typically low cost and non-electric (King, 1999).

Universal Design for Learning (UDL)—Curriculum and instructional materials that follow guidelines to provide access to the classroom environment and academic content for students who have a wide range of abilities from varied backgrounds (D. H. Rose, Hasselbring, et al., 2005).

Summary

In accordance with The Elementary Secondary Act (ESEA) (2001) and IDEIA (2004), students with disabilities are expected to meet the same curriculum and state wide assessment standards as their non- disabled peers. In order to adhere to these mandates, teachers must ensure that accommodations are available to meet the needs of these

students. UDL recognizes that no single option will work for all students and can give teachers the opportunity to create classrooms where students use technology to manipulate their environment, including the curriculum (Hitchcock, Meyer, Rose, & Jackson, 2002). Therefore, it is important that teachers understand the significance of AT and how it can be employed support instruction and thus facilitate learning for students with learning disabilities. Appropriate accommodations can include the use of AT devices. Using AT fosters belonging and participation in general education classrooms for students with LD (Duhaney & Duhaney, 2000; Quenneville, 2001).

The purpose of the study was to examine secondary general education teachers' perspective of assistive technology use for students with disabilities. Chapter II provides a literature review of the academic and social needs of secondary students with LD, assistive technology studies which describe positive student outcomes in math, reading, and writing, teachers' perceptions of technology, and finally barriers that may interfere with the implementation of AT. Chapter III provides an in-depth description of the design of the study, the participants, instrumentation used, administration, and data analyses. In Chapter IV the results are presented for both quantitative and qualitative data collected. In Chapter V, the results will be discussed and the need for future research provided.

CHAPTER II

LITERATURE REVIEW

Introduction

Currently there are approximately 2.8 million students with learning disabilities in schools across the United States (Marino, Tsurusaki, & Basham, 2011), and the achievement gap continues to be a critical issue for these learners because they are expected to meet the demands of the general education curriculum (Kennedy & Deshler, 2010). This is especially true for those students transitioning into secondary grades where curricular goals are accelerated to meet the expectations of high stakes testing (Maccini et al., 2002; Zascavage & Winterman, 2009). Fortunately, advancements in technology such as assistive technology (AT) are available to improve the academic outcomes for students with learning disabilities (Marino et al., 2011; McKenna & Walpole, 2007; Okolo & Bouck, 2007). By creating accessible and engaging instruction through universal design for learning (UDL) and AT, older students with LD may be motivated to participate during instruction and bypass repeated failure (Garderen & Whittaker, 2006).

Taking into consideration the obvious need of assistive technology for students with learning disabilities, the literature on increasing demands for general education teachers to be acquainted with the purpose and issues surrounding AT is replete (Biddle, 2006; Duhaney & Duhaney, 2000; Simpson et al., 2009; White et al., 2003). However,

many teachers are unsuccessful in this endeavor (Edyburn, 2009; Pierce & Ball, 2009). The purpose of this literature review is to discuss secondary teacher perceptions of assistive technology usage for students with learning disabilities. In doing so, it is important to examine how AT and UDL impact the academic and social needs of secondary students with LD, to describe AT studies associated with positive outcomes for students with LD, to understand the perceptions of teachers, and to recognize the barriers associated with integration of AT in schools.

Academic and Social Needs of Students with Disabilities

In today's classrooms, technology has the potential to profoundly change instruction. Assistive technology plays an essential role for teachers who work with students with disabilities in the general education setting (Alpher & Raharinirina, 2006; Marino, 2009; Traynor, 2003; Van Daal & Reitsma, 2000). Not only does it make some of the routine teaching tasks easier, but technology also allows a teacher to create learning activities and set up inclusive learning environments that enable the child with disabilities to learn, hence, minimizing the learning gap between students with disabilities and their non-disabled peers (Beck, 2002; Edyburn, 2000, 2002, 2003a). The use of technology in the classroom is becoming a necessary component in the way teachers and students retrieve information and extend their knowledge. This is important considering millions of students in the United States experience significant difficulties in school because of literacy deficiencies (Marino, 2009). The majority of these students are educated in general education classrooms and the classroom teacher is at the core of helping these students develop high levels of literacy. Teachers play a pivotal role in

helping students develop phonemic awareness, phonics, fluency, vocabulary, and reading comprehension (Bursuck & Blanks, 2010). Despite the efforts federal and state policymakers have made toward improving the literacy skills, secondary students with LD continue to fall behind. Therefore, it is important to examine the social and academic needs of students with LD in order to bridge the gap between teaching and technology.

Learning Disabilities

According to the American Psychiatric Association (2000), a learning disability is recognized when the progress of students is less than that expected on standard tests of reading, mathematics, and writing based on age, education and intelligence level. Learning disabilities are associated with problems in listening, reasoning, memory, attention, selecting and focusing on relevant stimuli, and the perception and processing of visual and/or auditory information (National Joint Committee on Learning Disabilities, 2008). These processing difficulties are presumed to be the underlying reason why students with learning disabilities experience one or more of the following characteristics: reading problems, deficits in written language, underachievement in math, poor social skills, attention deficits and hyperactivity, and behavioral problems (M. King-Sears, Swanson, & Mainzer, 2011).

Learning Disability in Reading

Difficulty with reading is by far the most common characteristic of students with learning disabilities (Jitendra & Gajria, 2011; Mastropieri, Scruggs, & Graetz, 2003; Wei, Blackorby, & Schiller, 2011). A learning disability in reading affects the student's ability to decode and/or understand the meaning of words and passages (Dentón & Vaughn,

2008). Currently, there are approximately eight million students struggling with reading difficulties in upper-elementary and secondary grades (Biancarosa & Snow, 2006). According to the National Assessment of Educational Progress results (as cited in Melekoglu, 2011), an average of 69% of students in fourth grade, 71% of adolescents in eighth grade, and 60% of adolescents in 12th grade read below the proficient level, meaning that those students do not demonstrate strong grade-level reading proficiency. Likewise, reading proficiency is bleak for students with learning disabilities. To illustrate, an average of 87% of fourth-grade students and 93% of eighth-grade adolescents with disabilities in public schools read below the proficient level (Melekoglu, 2011). In order to address this crisis, it is important to understand how curriculum demands affect secondary reading instruction.

Demands of Secondary Classes

Over the past 30 years the literacy performance for 13- and 17-year-olds has remained flat largely due to the dramatic transition secondary students undergo in regards to reading instruction (Deshler, 2010). When placed side by side, the curriculum demands in reading in the elementary grades and secondary grades are a sharp contrast. At the elementary level students are considered competent readers if they can sound out words and follow a simple plot. However, when students enter middle and high school they are expected to move beyond decoding texts and respond to reading reassignments that (a) are much longer and more complex at the word, sentence, and structural levels; (b) present greater conceptual challenges that affect reading fluency; (c) contain detailed graphics that often do not stand on their own; and (d) require an ability to synthesize

information (Deshler, 2010). In addition to these requirements, students are expected to understand and use different types of strategies and approaches in all content areas. Further complications arise when textbooks are introduced. Not only does the length of text increase but the information becomes more varied, which is opposite from the early grades when reading was simply reading. After transitioning to secondary reading students discover that textbooks do not follow the same pattern when presenting text or diagrams, and that none of the textbooks will resemble other sorts of materials such as newspaper stories, reference materials, web pages, and technical manuals. In order to succeed in secondary grades and beyond, students must be able to adapt to a range of academic texts, each of which requires its own set of literacy skills, including those students with learning disabilities.

Academic Concerns for Students with Learning Disabilities

According to a report from the National Center for Learning Disabilities (NCLD) (2013) in 2008–2009, 64% of students with learning disabilities left high school with a regular diploma compared to 73.9% of their non-disabled peers. Reading instruction at the secondary level is important, and it is necessary (J. Brunner, 2009; Malmgren & Trezek, 2009). However, many students with LD exhibit severe deficiencies in reading and encounter more academic problems than their peers. Roughly 80% of students with LD show sign of reading deficiencies as the primary cause of their disability (Melekoglu, 2011) which in most cases contributes to the growing achievement gap of disabled and non-disabled students (Malmgren & Trezek, 2009). The reading performance of students with LD is an average of 3.4 grade levels behind their peers without disabilities

(Melekoglu, 2011). This may be due to decreased remedial reading instruction that students received at the secondary levels (Vaughn et al., 2010). As Melekoglu (2011) states, the impact of reading instruction fades starting in fourth grade, when content area learning (e.g., science, history, and mathematics) becomes the main focus of daily instruction causing a decline in reading achievement for secondary students with LD. Much of this decline is due to problems in reading comprehension. These issues are often rooted in word recognition skills that are not automatic, but they may also stem from insufficient prior knowledge, limited cognitive ability or problems with working memory, locating main ideas, inference making, flexibly selecting and applying strategies, and monitoring and evaluating strategies (Biancarosa & Snow, 2006; Edmonds et al., 2009; Gersten, Fuchs, Williams, & Baker, 2001; Mastropieri et al., 2001; Moats, 2001). This delay in developing foundational skills in reading results in delays in other academic areas that require the use of these skills (e.g., writing, spelling, science, math, and social studies; NCLD, 2013).

Since reading problems do not dissipate on their own many secondary students stay in a remedial reader cycle. As a result, this lack of reading comprehension mastery affects students' motivation to read (NJCLD, 2008; Sideridis, Mouzaki, Simos, & Protopapas, 2006); leading to an unacceptably low graduation rate for students with disabilities. Without motivation and positive attitude toward reading, secondary students with disabilities may also develop social and emotional issues.

Social and Emotional Concerns

Accompanying the literacy crisis for students with LD is the development of learned helplessness. When students take on attributes of learned helplessness they adopt negative feeling toward achievement and think they have no control over their success (Canino, 1981; Kleinhammer-Tramill, Tramill, Schrepel, & Davis, 1983; Sideridis, 2003). The term "learned helplessness" was originally introduced in 1967 by Seligman and Maier (Sideridis, 2003). They proposed that two major characteristic associated with learned helplessness were motivation and cognition. However, this theory was revised in 1978 by Abramson, Seligman, and Teasdale (Sideridis, 2003). Their changes added emotional as another characteristic of learned helplessness because when a person experiences repeated uncontrollable negative outcomes depression or loss of self-esteem manifests. This is true for many students entering into upper elementary or secondary classrooms (Performance-avoidance, 2008). In a large-scale study, Valas (2001) reported that students with LD showed helpless behaviors and attributed their failure to lack of ability, had lower self-esteem, and also exhibited adjustment problems, compared to typical students. Likewise, Sideridis (2007) completed a study of 104 upper elementary students with LD. The study found that performance avoidance goals were linked positively to anxiety, depression and negative effect, while negative paths were found with regard to self-esteem and positive affect. Sideridis concluded that performance-avoidance goals may constitute a vulnerability factor that triggers the mechanism of depression when negative thoughts occur. Since students with LD exhibit atypical

learning characteristics compared to their non-disabled counterparts (Melekoglu, 2011), it is important to understand the social consequences.

Over the past three decades research has explored the social and emotional needs of students with learning disabilities (K. A. Kavale & Forness, 1996; K. Kavale & Mostert, 2004; NJCLD, 2008; Sideridis, 2003). It soon became evident that students with LD showed problems with social competence that were characterized by problems in self-regulatory behavior (Miller, Lane, & Wehby, 2005), social perception (Hughes et al., 2011), and social interaction (Milsom & Glanville, 2010). K. A. Kavale and Forness (1995) noted that this range of social deficits is a prominent feature with about 75% of students with LD. These inappropriate social behaviors can lead to a decline in social interactions as well as academic performance (Hughes et al., 2011).

Learning disabilities and social skills deficits often co-exist causing students to have decreased academic achievement (Womack, Marchant, & Borders, 2011). In most cases reading is where many of these students inadequately perform (Deshler et al., 2004). Consequently, this deficit leads to inadequate postsecondary school or work environments for students with Learning disabilities (Hughes et al., 2011; Kiuru et al., 2011). Melekoglu (2011) reports that 37% of adolescents with LD pursue some type of postsecondary education such as vocational or technical schools, community colleges, but only 9.7% of these graduates enroll in a four-year college. Moreover, many jobs require proficient reading skills, causing employment opportunities to diminish for struggling readers with LD after graduation (NJCLD, 2008). Effective social skills are critical to successful school performance and smooth transition into adulthood.

Promoting Access to the General Curriculum

AT is recognized as a crucial rehabilitation option for persons with physical disabilities, however, AT also has received attention as a valuable tool for helping individuals with learning disabilities (Beck, 2002; B. Bryant, Bryant, Shih, & Seok, 2010). In order to understand the role of AT and its relationship to student achievement requires teachers to understand the purpose of AT and how it works for students with learning disabilities (Hertzroni & Shrieber, 2004). Equally, teachers should recognize students with LD may rely on using these tools in an accessible setting. Universal Design for Learning has been adopted into K-12 education to meet the demand of accessibility as well as support the use technology (Meo, 2008; D. Rose & Meyer, 2000a). The consideration of UDL philosophies coupled with AT devices would allow students with LD to progress in the general education curriculum. With a rise of research-based differentiated instruction and assistive technology, UDL has emerged as a framework to serve as the "intersection of initiatives" (Meyer & Rose, 2002, p. 7).

Universal Design Networks and Assistive Technology

Blending AT with UDL practices, including differentiated instruction and cooperative learning, provides secondary students with LD an opportunity to overcome barriers like the literacy demands of the general education curriculum (Coyne et al., 2006). To achieve this goal, Rose, Myer, et al. (2005) suggested three essential qualities of universally designed curriculum that is designed to provide multiple (a) representations of the content, (b) options for expression, and (c) options for engagement.

Multiple means of representation. Universal design allows content information to be presented in multiple and flexible formats. For example, if printed text is the sole means of presenting content information, then students who have limited vocabulary, difficulty reading, visual impairments, or language barriers may be limited in their access to this particular text.

Multiple means of expression. Working within a flexible instructional setting allows teachers to offer multiple ways students can express their understanding of knowledge learned. Several options include drama, music, or video to enable students to express their ideas and knowledge. Moreover, technology promises to provide students with avenues for expression. For example, students can use (a) VoiceThread to create slide shows in order to share their work in an auditory format as well as visually, (b)UDL Bookbuilder, to build stories; or (c) websites to demonstrate knowledge such as the National library of Manipulatives, and other Online activities.

Multiple means of engagement. Understanding how to motivate students can be the key to helping students stay engaged during instruction. However, students differ in the ways in which they can be engaged or motivated to learn. AT has the potential to motivate learners to respond positively to instruction in their own way. Some devices or software include voice avatars for digital text presentations or use of computer software to teach early reading skills such as Starfall.

The UDL framework provides guidance for creating flexible curricula and instructional environments, as well as using technology to maximize success for all students (Bernacchio & Mullen, 2007; Wehmeyer, 2006). UDL allows teachers to

recognize students' barriers to learning and strategically address these barriers. When an understanding of UDL principles and technology-based teaching is realized, then perhaps AT may be included to continuously increase student learning and create best practices for teaching in diverse classrooms.

Assistive Technology Effectiveness Research

When students with disabilities are unable to meet academic goals, it is important for educators and families to recognize the impact of the disability on academic performance and plan appropriate interventions (P. Parette & McMahan, 2002). These interventions generally originate from a student's Individualized Education Program (IEP), which describes the education needs in the form of goals and objectives for students and provides a blueprint for services (Bausch & Ault, 2008). One service that is available is assistive technology. Assistive technology could appear in the following three places in an IEP: in the annual and short term goal objectives, the list of supplemental aids and services, and the list of related services needed to help the students attain academic success (H. Lee & Templeton, 2008). When IEP teams include AT in the short-term goals and objectives, the goal should be specific as to how and why the assistive technology device can help the student accomplish the educational goal (H. Lee & Templeton, 2008). Assistive technology increases the possibilities for individuals who have a wide range of intellectual and physical disabilities to be more independent and interact in their social or educational environments (Dyal et al., 2009; Edyburn, 2009; Kara-Soteriou, 2009; Williamson-Henriques & Friend, 2012). Moreover, assistive technology devices, by helping students learn specific educational and social tasks can

help students remain eligible to learn in the least restrictive environment. With these objectives in mind, a synthesis of AT research is included. The research areas are separated into the following sections that impact teaching and learning for students with LD: (a) reading, (b) written language, and (c) math.

Reading. As many as eight out of ten students with learning disabilities have reading problems so significant that they cannot read and understand grade-level material (Hasselbring & Bausch, 2006). Generally, students with reading disabilities have deficits in phonemic awareness, word identification, reading fluency, vocabulary, and comprehension. Literacy is one area in which practical assistive technology can support students with learning disabilities. According to Hasselbring and Bausch (2006), assistive technology breaks down barriers to full literacy in two ways: (a) as a reading support, meaning that computer-based applications help students with learning disabilities successfully access grade-level text as they read, and (b) as a reading intervention, meaning that the technology helps students strengthen and improve their overall reading skills. For instance, many students in upper elementary and middle school experience difficulty in the area of reading because many of the strategies provided in the lower elementary grades are not available (Vaughn et al., 2010). Therefore, AT can play an important role in supporting students with LD in both of these areas. For example, LD can interfere with student's foundational skills in phonemic awareness decoding, and comprehension. Computer programs have been developed to support the acquisition of foundational reading skills (McKenney, & Voogt, 2009; Passey, Rogers, Machell, McHugh, & Allaway, 2004; Pearman, 2008; Stanford &

Reeves, 2007). For example, Olsen and Wise (as cited in Higgins & Raskind, 2000) reported that students with word recognition difficulties who read stories with speech feedback showed significant improvements over peers who spent reading time in regular instruction. Similarly, Hasselbring and Bausch (2006) report that the computer-based Read 180 program produced significant gains for students in the area of reading comprehension and fluency in the Des Moines Independent Community School District: 18% of the students who received the intervention no longer needed the support of special education. The reading software program Read &Write Gold offers text-reading software that allows students to read independently in class (Hasselbring & Bausch, 2006).

Engaging students with reading disabilities can be an overwhelming task for teachers. However, integrating AT devices could raise students' confidence and decrease their isolation in the general education setting. With the increased access to technology, students with disabilities can be afforded every opportunity to actively participate in class discussions during reading as well as enjoy books that are being read by peers.

Written language. Writing is integral to many learning activities, and most children write without much difficulty. However, writing often is challenging for students with learning disabilities. Written language disorders occur in the context of reading and arithmetic (Siegel, 1999). Dysgraphia is the term used to describe children who have written language expression difficulty (Duel, 1994). Developmental dysgraphia is described in conjunction with dyslexia, motor clumsiness, or spatial difficulty (Duel, 1994). Students with dysgraphia write more slowly and, form letters

incorrectly; their final products are often messy and illegible (Lewis, Graves, Ashton, & Kieley, 1998). Students with learning disabilities are also likely to experience problems in the area of punctuation, spelling, spacing, and margin creation. Computers can facilitate the writing process by making it easier to develop and record ideas, edit ideas, and publish and share writing with others (Edyburn, 2000; Siegel, 1999). Different computer supports are useful during different phases of the writing process and can increase motivation, help students maintain attention, stimulate cognition, and illustrate content. Computers offer other support by motivating reluctant writers, facilitating motor actions, providing spelling assistance, helping with revising and editing, and producing a document that is neat and legible (Edyburn, 2003a). Studies have shown that word processing can generate positive outcomes for students. For example, C. MacArthur (2009) showed that when computers are combined with effective instruction in revision, word processing could yield benefits for students with written language disabilities. Similarly, Gregor, Dickinson, Macaffer, and Andreasen (2003) state that word processors give consistent and clear text on the screen and provide spell checking and limited grammar checking. Hertzroni and Shrieber (2004) compared student products that were composed with or without word processing. The results indicated that students using word processing produced writings that reflected fewer spelling mistakes and better organization. The results also revealed that students were able to read their own work with fewer reading errors. All of these studies indicate that the use of word processors can lead to improved writing outcomes for students with learning disabilities. When writing instruction that includes technology can enhance the quality of final written

products, facilitate communication, and promote interaction for all students, especially secondary students with disabilities.

For many students with learning disabilities, spelling is a challenge (NRP, 2001). Computer-assisted instruction may provide promising instructional opportunities for initial reading and spelling skills (Gregor et al., 2003; Higgins & Raskind, 2000; C. A. MacArthur, 2000; Van Daal & Reitsma, 2000). C. A. MacArthur (2000) reviewed research on computer-based word recognition programs used with six students with learning disabilities. The findings indicated that the word recognition program used provided successful academic outcomes in the area of spelling, reducing the number of misspelled words by half for five of the six students. Similarly, Wanzek, Vaughn, and Wexler (2006) examined the effects of spelling and reading interventions on the spelling outcomes of students with learning disabilities in 19 previously conducted studies. The findings demonstrated that spelling outcomes were consistently improved when explicit instruction, corrective feedback, frequent opportunities for practice, and the use of assistive technology was available. Van Daal and Reitsma (2000) reviewed a pilot study which used *Leescircus,* a corrective feedback drill-and-practice computer-assisted instructional tool that was used with students who had reading difficulties and lacked motivation. The study indicates that motivation and spelling skills for students were increased during computer practice and decreased during traditional class instruction.

Mathematics. The primary focus during math instruction is to help students understand how to manipulate numbers using specific operations, such as adding, subtracting, multiplying and dividing, as well as providing students with instruction in the

area of critical thinking and problem solving. Difficulties in mathematics are common among students with learning disabilities. Their math difficulties can range from knowledge of basic facts, telling time, solving word problems, algebra, or money-related equations (Edyburn, 2003a). According to Woodward and Rieth (1997), students with disabilities can benefit from tools that range from hand- held devices to computer programs that will allow students to solve higher-level mathematical problems. Unfortunately, many teachers do not provide assistance to their students other than review worksheets, flashcards, or other remedial activities (Alpher & Raharinirina, 2006). Computer software, virtual manipulatives, and adaptive calculators can provide the support students with disabilities need to acquire mathematical skills and knowledge (Edyburn, 2003a).

Assistive technology in educational environments can be integral to the attainment of learning for students with learning disabilities. Assistive technology is considered to be compensatory because the devices can be used to enhance the ability of a person who has a learning or physical disability to independently do or perform a task at the expected level (B. Bryant et al., 2010). Therefore, incorporating appropriate AT in general education classrooms can help keep students with disabilities involved in learning. While assistive technology offers many benefits, teachers encounter obstacles. The next section will identify barriers to effective integration of AT within classrooms.

Barriers to Technology Integration in Schools

In education, the goal of assistive technology is to provide access to the general curriculum for students with learning disabilities. This includes, but is not limited to

adaptive switches, communication devices, sensory enhancements, and computer access. According to researchers, assistive technology plays a role in enhancing student skills, increasing motivation, and making the process of obtaining knowledge equitable (Gulbahar, 2007; Rose, Hasselbring, et al., 2005; Silver-Pacuilla, 2006). In spite of the strong push to get technology into instructional practices, many barriers to implementation still exist (Levin & Wadmany, 2006; Palak & Walls, 2009; Pitler, 2006). Several studies have been conducted to investigate barriers which impeded integration of technology in education (Bingimlas, 2009; Dawes, 2001; Earle, 2002; Schoepp, 2005). Of these barriers researchers point out the following factors that prohibit successful integration.

Teacher-level Barriers

Ensuring that students with LD receive instruction designed to meet their educational needs while being taught in the general educational setting, to the highest expectation, continues to be the goal of special and general education teachers (Friend & Shamberger, 2008). Using AT is one approach to supplement traditional methods of teaching and actively engage these students by (Beck, 2002; Collins, 1992; Edyburn, 2006). Assistive technologies allow students with disabilities to interact more easily within social and academic settings. Ertmer and Ottenbreit-Leftwich (2010) note technology advancements in the classroom have been powerful, but until the teacher becomes an agent of change the technological advancements will be incapable of producing the intended outcomes. With this in mind, it is important to understand teacher perceptions of technology in relation to areas concerning students with disabilities.

Teachers' perception of students with disabilities. The success of inclusion depends on many factors, including the attitudes of professional educators and the quality of instruction they offer their students (Damore & Murray, 2009). Teachers' attitudes toward inclusion have been found to be closely linked with acceptance of children with disabilities into general education classrooms. In general, teachers have been found to be unwilling to accept a child with a disability into the regular classroom (B. G. Cook, 2001; B. G. Cook, Semmel, & Gerber, 1999; B. G. Cook, Tankersley, Cook, & Landrum, 2002; Frolin, Hattie, & Douglas, 1996). Ysseldyke (2001) pointed out three factors that could impact teacher perceptions towards students with disabilities: first, professionals hold stereotypes about the kinds of students who have disabilities, and nearly all of these have unfortunate consequences. Secondly, educators hold stereotypes of the kinds of students who can achieve or be successful, which affect student outcomes. These stereotypes are often derived from labels assigned by society such as *learning disabled*, which could lead teachers to believe a student is not capable of achievement. Thirdly, the expectations and performance of students with disabilities are often low, causing teachers to believe that students with disabilities are neither confident nor capable of achieving high standards. Although this study was conducted over ten years ago many of these stereotypes continue to exist in schools (Dupoux, Wolman, & Estrada, 2005).

Teachers' perception of inclusion. Since the 1997 reauthorization of the Individuals with Disabilities Education Act (IDEA), an increasing number of children with special needs are taught in general education classrooms (W. Johnson, 2008; Scheeler et al., 2010; Simpson et al., 2009; Voltz & Collins, 2010). Inclusion involves

more than just having a child with a disability in the class. Inclusion focuses on how to restructure the curriculum to meet the needs of these students in order to move toward teaching all students together (Damore & Murray, 2009). Although general education teachers have a wide range of abilities and skills (Brown-Chidsey, 2007), meeting the needs of all students in the classroom can be a challenging task.

In reviewing the research on teacher perception of inclusion, both affirmative and disapproving views were discovered. For example, DeSimone and Parmar (2006) examined secondary teachers' perceptions of teaching students with learning disabilities in inclusive settings. From this study the majority of the general education teachers believed that they were primarily responsible for modifying the instruction for students with learning disabilities and for ensuring their success in general education settings. However, about 50% of these teachers indicated that they were partially comfortable or not comfortable in adapting instruction to meet the needs of students with learning disabilities. This finding suggests that although general educators seem to be willing to take responsibility for providing instruction to students with learning disabilities in general education settings, they are less comfortable about their ability to meet these students' needs. Additionally, Leyser and Tappendorf (2001) specified several factors that impact teachers' attitudes towards inclusion of students with disabilities into the general education classroom. These authors cited such variables as teacher experience, gender, and experience with children with disabilities, and whether the teacher had taught special education as being possible determining factors with respect to attaining positive outcomes for children with disabilities in an inclusive class. In contrast, many general

education teachers view special education students as inappropriately placed in general education classrooms (Carter, Prater, & Dyches, 2009). To illustrate, participants in a study by Bunch and Finnegan (2000) believed that inclusive education contributed to academic achievement of students with and without disabilities. However, 65% of the participants in this study were very concerned that all students would not be adequately challenged and 60% of the teachers surveyed were concerned that class standards would change for the worse in the inclusive classroom. For example, several interviewees provided specific examples of how the inclusion of students with disabilities could have a detrimental effect on students without disabilities enrolled in the inclusive class. The effects included: the need for extra time for the student with special needs; the fear experienced by students during outbursts by a student with special needs; and the distraction caused by the teacher assistant working in the same classroom. Likewise, Schulte, Osborne, and Erchul (1998) reported several impediments to effective inclusive practices. These obstacles include deficits in general education teachers' skill levels, time available for instructional planning and difficulty implementing individualized and/or small group instruction within a large group.

Although students with LD have underlying academic and social deficits, they are still held to the same curriculum and standards as their nondisabled peers. Understandably, this can seem to be an overwhelming task for general education teachers (MacLean, 2008). However, the general education teacher, is the content-area expert, and the primary person qualified to teach the curriculum to the students (Brown-Chidsey, 2007); thus, working with students with disabilities is not an option but an imperative.

Teacher's perception of individualized education programs. High stakes testing and Adequate Yearly Progress (AYP) hold school districts accountable for student academic growth; among those are students with learning disabilities. Many students with LD are taught in inclusive settings with non-disabled peers and are expected to meet goals and objectives from the same standard course of study. To ensure success in the classroom, these students have accommodations specific to their needs. This is done by providing them with an individualized education program (IEP). The IEP serves as a roadmap for teachers and parents to gauge the improvements of the student's level of academic, social, or adaptive performance (Lee-Tarver, 2006). The following studies describe teacher perceptions of IEP's and IEP accommodations.

Lee-Tarver's (2006) study on one hundred and twenty three general education teachers found IEP's useful tools in planning and implementing educational goals and objectives for children with disabilities within their classes. The survey questions included four sections concerned with the efficiency of IEPs in providing students within special education with appropriate educational goals and evaluation of academic achievement. For the purpose of this review one of the survey questions was used. This question was: "IEP goals and objectives provide a curriculum for my students." The results revealed that 48% of teachers agreed and 15% strongly agreed that Individualized Education Plans (IEPs) provide a curriculum for special education students currently within their classrooms. Twenty-one percent of teachers disagreed and 5% strongly disagreed that IEPs provide a curriculum for their students. From this study researchers concluded that teachers held a high regard for IEPs and general education teachers are

becoming active and vocal participants in the IEP process. Similarly, Molto's (2003) study explored general education teachers' perceptions of the feasibility, effectiveness, and desirability of implementation of accommodations. The participants consisted of 89 general education teachers ranging from grades K-12. These results indicated moderate teacher acceptance of instructional accommodations. Sixty-two percent of the participants considered instructional accommodations as feasible and 51% consider them to be effective. The findings in both of these studies point toward acceptance and use of IEPs from general education teachers. In contrast, several studies suggest that general education teachers are not using accommodations to support student learning. Leyser and Tappendorf (2001) note general education teachers do not frequently implement differentiated instructional strategies necessary to accommodate students with special needs. In this study researchers examined the attitudes of general and special education teachers regarding inclusion. Ninety-one participants from grades K-12 were surveyed. Sixty-eight of the 91 participants were general educators and seventeen were special educators. From this study researchers noted that demographic variables such as certification, grade level, gender, and training, were found to be related to attitudes toward inclusion and teacher use of instructional accommodations. For example, female teachers and teachers with less experience had more favorable attitudes toward inclusion and instructional accommodations. Likewise, a literature review by Scott, Vitale, and Masten (1998) examined classroom teachers' perceptions and use of accommodations for students with disabilities. The findings and review revealed that although general education teachers felt positive about the effectiveness, reasonability, and feasibility of

making instructional adaptations for students with disabilities in the general education classroom, these same teachers were unlikely to move away from whole group instruction to address student-specific individualized accommodations. The authors noted that a lack of teacher training and limited in-school support served as barriers for the classroom teacher as it related to providing accommodations to support individual students.

The Individuals with Disabilities Education Act (2004) identifies assistive technology (AT) as an integral part of the individualized education plan. IEP teams must understand how AT can influence academic outcomes for students with LD. The Individualized Education Program (IEP) is the basis for determining the appropriate education for a student with disabilities (Torgerson, Miner, & Hong, 2004). Therefore, it is important for general education teachers to possess the knowledge and skills about assistive technology to help develop and implement IEP's.

Teachers' perceptions of technology. While assistive technology is more prevalent these days, the rate to which it is being used for students with LD in schools is varied (Edyburn, 2009). Teachers' perceptions toward using technology for teaching and learning can have a significant impact on the frequency with which they use the technology (Pierce & Ball, 2009). According to Marino (2009), "As the global community continues the transition from an industrialized factory model to an information and now participatory networked-based society, educational technology will play a pivotal role in preparing students for their futures" (p. 187). In education we often hear the expression, "people tend to teach the way they were taught" (Bull & Cooper,

1997, p. 3). If students emulate the practice of classroom teachers, then students' use of technology in social and educational contexts will be based on the examples set for them by their teacher (Brown & Henscheid, 1997; C. Brunner, 1992; Bull & Cooper, 1997). Since technology is strongly interwoven in today's society and has become vital to human welfare and economic prosperity (F. H. Chen et al., 2009), the role of the teacher as a technology leader in the class is critical (Rohaan, Taconis, & Jochems, 2009). The impact teachers can have on students is significant and can lead to technologically literate students. Moreover, it is assumed that teacher knowledge affects teaching and thus affects the pupils' concept of and attitude towards technology (Rohaan et al., 2009). Thus focusing on teachers perceptions of technology is important for understanding what happens in the classroom.

Teachers' perceptions and uses of technologies are central in minimizing the learning gap between students with disabilities and their non-disabled peers (Buehl & Fives, 2009). When trying to integrate technology into their instruction, teachers refer to their existing beliefs and prior experiences. Existing beliefs of teachers can influence the development of beliefs about both technology integration and related practices (F. H. Chen et al., 2009). A number of studies on teacher perception have verified that teacher beliefs have an impact on the teachers' use of technology in the classroom (F. H. Chen et al., 2009; Ertmer & Ottenbreit-Leftwich, 2010; John, 2005; Yuen & Ma, 2008). For example, Coppola (2004) conducted a study and found that teachers used technology when they believed that it was useful and could be seamlessly integrated during instruction. Similarly, Snoeyink and Ertmer (2001/2002) indicate that when teachers

recognized the value for using technology for specific purposes, they were more likely to use technology in spite of barriers. Furthermore, Zhao and Cziko (2001) state that in order for teachers to effectively use technology, they must believe that (a) technology can help them to achieve higher level goals more effectively, (b) technology use will not disturb higher-level goals, and (c) they have adequate ability and sufficient resources to use technology.

Huge advances in assistive technology have occurred over the past two decades along with the advances in computer-based technology (Edyburn, 2003a). These advances have resulted in the increase in the selection of devices available to enhance the participation of students with disabilities. However, the benefits of these innovations cannot be realized by students unless teachers are adequately prepared to operate the equipment and integrate it within their classroom routine. Continuing with the preceding idea that teachers have to be change agents, it is critical that teachers believe in their own abilities to implement these changes within their classrooms (Ertmer, 2005). According to Palak and Walls (2009), even if teachers change their pedagogical beliefs and accept the notion of technology, they still must have the confidence to implement it within their classroom. Although the availability of assistive technology for students with LD is increasing, the lack of awareness and the lack of training continue to act as major barriers to teachers using assistive technology.

Lack of confidence and competence. Although AT has the potential to provide equitable academic support for students with LD, researchers recognize that teachers still face challenges in implementing these tools (Judson, 2006). One barrier that may impede

teachers from using technology is a lack of confidence (Dawes, 2001). In a study conducted by Beggs (2000), teachers reported that "fear of failure" prevented them from implementing technology in their classes. Likewise, a study completed by Balanskat, Blamire, and Kefala (2006) revealed that teachers were anxious about using technology because of their limited knowledge, reducing their confidence level when teaching with technology. In each of these studies the primary outcome identified by respondents was fear of teaching children who knew more about technology than themselves.

Competence is another barrier for technology integration for teachers (Bingimlas, 2009). A lack of proficiency can occur because many teachers lack knowledge and skills to use computers or software and are thus often less enthusiastic about integrating them into their classrooms. The lack of teacher confidence and competence is a major barrier for many teachers and begs the attention of school-level administrators. One suggestion mentioned by the researchers to correct this barrier is professional development programs that emphasizes basic skills, and, more importantly, pedagogical and content knowledge related to content specific technology (Ertmer, Gopalakrishnan, & Ross, 2001).

Resistance to change or negative dispositions. Several research studies indicate that teacher dispositions and resistance to change were significant barriers in regards to technology usage (Earle, 2002; Ertmer, 1999, 2005; Judson, 2006; Levin & Wadmany, 2006). These studies point to teachers having incomplete or incorrect understanding of technology, causing them to have conflicting beliefs about technology. Bingimlas (2009) supports this claim by asserting that teachers' attitudes towards technology largely depend on what teachers understand about the outcomes associate with technology use

for their students. Additionally, Schoepp (2005) did a study which revealed that teachers were not being supported during instruction or not receiving guidance on how to integrate technology into their teaching.

School-level Barriers

Building level administrators are responsible for the management of the student and teacher body with regard to technology practices (Davies, 2010). However, studies indicate the lack of support, time, and resources from school leadership impede the usage of technology (Schoepp, 2005). Although each of the above-mentioned barriers is equally important, researchers found that time restraints, lack of planning, and scheduling computer time were also major restrictions vis-à-vis technology usage by teachers (Beggs, 2000; Schoepp, 2005). If teachers are expected to include technology into the curriculum, school administrators need to offer support for teachers as they begin to prepare technology-rich lessons.

Accessibility. Even though dispositional barriers exist for teachers, many teachers may be ill-equipped and ill-prepared due to accessibility. Reduced accessibility can often lead to difficulty with teaching students in technology-rich lessons, reduced chances of selecting low-risk technology approaches to teaching; and/or avoiding technology altogether in the curriculum (Glazer, 2004; Hunter, 2001). Various research studies indicated a few reasons for the lack of teacher access to technology. In Sicilia's (2005) study, teachers complained about how difficult it was to gain access to computers or computer labs. Some of this difficulty was due to the fact that computer labs needed to

be scheduled in advance (and teachers often forget to do so), or teachers were restricted from using the labs during certain periods of the day.

Technical support. In the absence of good technical support teachers cannot be expected to overcome technology-related issues. In a study conducted by Pelgrum (2001), teachers noted the top barrier to technology use in education was the lack of technical assistance. Additionally, in Sicilia's (2005) study, technical problems such as poor Internet connections, malfunctioning computers, slow Internet connection, and teachers having to work with old computers were found to be major barriers for teachers. The researchers in this study concluded that technical barriers impeded the delivery of instruction as well as the natural flow of classroom activity, both of which, in turn discouraged teachers from integrating technology into their lessons (Sicilia, 2005).

Collaboration with family. Assistive technology devices and services are most likely to be successfully identified and implemented in academic and social environments when IEP teams address family goals related to AT (P. Parette & McMahan, 2002). Since family decisions regarding assistive technology can be influenced by cultural and linguistic backgrounds and values, P. Parette and McMahan (2002) stress that IEP team members be sensitive to each family's expectations in order to maximize successful AT implementation in the school, home, and community. However, this type of collaboration is rarely established due to barriers families encounter in regards to AT selection and use. Wehmeyer (1998) surveyed 516 families of individual, with intellectual disabilities ranging from ages 1-21 and discovered that assistive technology devices were underutilized by these individuals. The respondents indicated the following

barriers that prohibited their students from using an assistive technology device: (a) lack of funding, (b) limited information about product, (c) assessment/evaluation was not available, (d) the device was unavailable, (e) the device was too complex, (f) maintenance of product was too difficult to sustain, and (g) inadequate training to learn how to use the device.

Funding. Financial support for assistive technology in the United States is complex and often creates challenging barriers for individuals with disabilities (Wallace, 2011). This is especially true when school districts are involved. Hasselbring and Glaser (2000) noted that funding issues in schools caused substantial barriers. They stated that schools are reluctant to provide assistive technology for students with learning disabilities due to budget restraints. Similarly, Kemp, Parette, and Hourcade (2001) note funding for assistive technology for school age children with disabilities is the largest barrier to access because of variation of qualifications from state to state, and too many clerical responsibilities on behalf of the applicant.

Assistive technology can improve teaching and learning in inclusive classrooms in various ways (Kleiman, 2010). Therefore, understanding the obstacles to technology usage faced by teachers, families, and administrators is critical because this knowledge could provide support for technology integration (Schoepp, 2005) and encourage greater use of assistive technology. Identifying the basic barriers could also assist education leaders in preventing them. Also leading to frequent technology usage (Bingimlas, 2009).

Summary

Teachers are responsible for the academic development of all learners. This task is a challenge for educators when they instruct students with learning disabilities. As more students with learning disabilities are being taught in inclusive settings, teachers could use strategies such as assistive technology to engage these learners as well as provide appropriate instructional delivery. The literature reveals connections between assistive technology devices in general education classrooms and academics for secondary students with LD. Since the presumption behind IDEA is that students with LD can perform at the same academic levels as their peers when given appropriate accommodations, teachers need to employ all means at their disposal to make this possible. The effective integration of assistive technology into their classrooms is one way for students to support their students with disabilities. There is evidence that general education teachers may be reluctant to integrate assistive technology at the elementary and postsecondary levels of education (MacLean, 2008). However, little research exists about teacher use and perceptions of assistive technology at the secondary level. It is important to examine secondary teachers' perceptions regarding their use of assistive technology as understanding their perspectives could provide a clearer picture of what supports need to be provided to facilitate their ability and desire to do so. Therefore, the goal of this mixed-methods study is to look at secondary teachers' perceptions of assistive technology. The methodology will be discussed in the next chapter.

CHAPTER III

RESEARCH DESIGN AND METHODOLOGY

Introduction

General education teachers are the primary educators for all high school students, including those with LD. This task is daunting because by 2014 many students in the U.S., regardless of disability, will be expected to pass the minimum requirements on state mandated tests (Dee & Jacob, 2011). Since students with LD struggle to make academic gains at the same rate as their nondisabled peers, the Individuals with Disabilities Educational Act (IDEA, 2004) requires educational institutions to provide students with LD classroom accommodations such as AT in order to help them demonstrate their academic abilities (Dyal et al., 2009). Yet, understanding and using AT can be an overwhelming task for teachers. Research shows that the underutilization of AT by teachers is a result of several factors: (a) lack of training opportunities for teachers (Bausch & Hasslebring, 2004; Todis, 1996); (b) teachers' lack of knowledge about technology in their content area (J. Harris, Mishra, & Koehler, 2009; Koehler & Mishra, 2008); and (c) teachers' attitudes and beliefs about technology (C. H. Chen, 2008; Levin & Wadmany, 2006). As a result, many general education teachers choose to forego the opportunity to use these devices.

Although studies have described barriers to the adoption and implementation of assistive technology (Copley & Ziviani, 2004; Jones, Valdez, Nowakowski, &

Rasmussen, 1995), few studies have investigated secondary teachers' perceptions on AT within inclusive settings. The rationale of this research is (a) to examine secondary teachers experiences of using AT in their respective content areas; and (b) to determine secondary teachers' perceptions of AT in relation to their level of use of these devices for students with learning disabilities. This study will contribute to the professional literature by clarifying the link between secondary teachers' beliefs and instructional practices. Particularly, it is designed to address the following questions and sub questions:

How do secondary general education teachers perceive assistive technology use during instruction for students with learning disabilities?

1. What are the experiences of general education teachers regarding the selection and implementation of AT devices in inclusive settings?

    Subquestion 1: Is there a significant mean difference of usage of AT between general education teachers who have taught less than 5years and teachers who have taught more than10 years?

    Subquestion 2: To what extent are general education teachers using AT for reading, writing, mathematics, listening, and organization/memory?

2. How do general education teachers perceive the use of Assistive Technology by students with LD?

    Subquestion1: What is the relationship between the number of years teaching inclusion classes and teacher perception of AT for students with LD?

Subquestion 2: Is there a significant difference between math and English teachers' perceptions of AT usage for students with LD?

3. What knowledge and skills do general education teachers think would facilitate their use of assistive technology in inclusive settings?

Subquestion 1: What knowledge and skills influence teachers' usage of AT?

Subquestion 2: What is the relationship between years of experience using AT and AT knowledge and skills amongst general education teachers?

4. What do general education teachers perceive as supports and barriers to assistive technology implementation?

Subquestion 1: What are the barriers to AT use in general education classrooms?

Subquestion: What are factors that support AT usage in general education classrooms?

Population and Sample

A convenience sample of secondary general education teachers working in inclusive settings was selected. The participants for this study were selected from a population of secondary teachers, special education teachers, and principals who work in one school district in the southeastern region of the United States. The criteria for inclusion in the study were as follows: secondary teachers with a certification in the area of English, mathematics, social studies, and/or science who teaches or had taught a

student with a reading, mathematical, or written expression learning disability; special education teachers who taught at the secondary level; and principals who worked at the secondary level. A list of secondary schools was compiled and the researcher contacted each school through electronic communication or by telephone. If a school expressed interest in the study the researcher obtained clearance from the institutional review board (IRB) and secured a letter of support from participating schools. In all, four secondary schools gave consent and 110 surveys were completed.

Instrumentation

The researcher selected a mixed-methods design because mixed-methods designs provide strengths that offset the weaknesses of using quantitative and qualitative research independently; mixed methods provides more comprehensive evidence as well as, an avenue for the researchers to solve problems numerically and descriptively (J. Creswell & Plano-Clark, 2007). This study included a survey, two focus groups, and eight semi-structured interviews. The purpose of using the survey was to take a broad view (B. Johnson & Christensen, 2008) from a sample of general education teachers in secondary schools implementing inclusive practices in order to draw conclusions regarding their use of assistive technology in their classrooms. The focus groups were the next part of the study and sought to understand the essence of how AT devices are implemented for students with LD and how aspects of teachers' perceptions facilitate or impede the process. Finally, the researcher employed semi-structured interview of the school principals and special education teachers.

Self-administered Survey

Although previous research has been conducted on assistive technology use for students with LD, no research was identified that specifically examined secondary teachers' perceptions on the use of these devices with students who are LD; therefore, no appropriate survey existed that could be used for this study. However, the researcher located a survey from a published dissertation and found some items relevant to the current study. Permission to modify and use the survey items was requested and obtained via through email on April 3, 2012 (Sharpe, 2010). To ensure the validity of the present instrument, faculty members from the researcher's university provided input on its design. In addition, a pilot study was conducted with general education teachers for additional input on the survey design. Revisions were made based on the input from faculty as well as written comments from participants of the pilot study. The resulting document was a hard copy of a self-administered survey that was distributed to participants. Demographic information was obtained at the beginning of the survey. The remaining three parts addressed (a) teacher usage of assistive technology, (b) teacher attitudes and beliefs about assistive technology, and (c) supports and barriers to assistive technology. The final part of the survey consisted of one open-ended question that solicited a written response from teachers about their experiences and perceptions regarding assistive technology and students with have learning disabilities.

With respect to demographics, participants were asked to respond to seven questions which included gender , number of years teaching, level of education, type of certification, whether they had taught classes that included students with learning

disabilities, number of years teaching an inclusion class, and experience with assistive technology. The first seven items from part one required responses based on a Likert-type scale ranging from *Strongly agree, Agree, Neutral, Disagree, Strongly disagree*, and *Not applicable*. Items from this section related to teacher usage of assistive technology. For example, "I understand how to differentiate a lesson by incorporating assistive technology" and "I know how to maintain the assistive technology devices that my student(s) and I use." Part two addressed teacher attitudes and beliefs about assistive technology and used the same Likert scale mentioned above. Sample items included: "assistive technology devices are useful for all core academic classes" and "overall, assistive technology devices help students with LD accomplish their tasks in my class." The third part focused on supports and barriers to assistive technology usage. Likewise, these questions used four-point Likert scale to respond to statements such as, "I have adequate training in and knowledge of assistive technology for my classroom needs" and "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." The final section of the survey was comprised of an open-ended question: "What other comments do you have regarding assistive technology in relation to students with LD in your classroom?" This item was intended to elicit more details of teachers' assistive technology experience.

Semi-structured Interviews

Semi-structured interviews were used to clarify themes in the study (Schensul, Schensul, & LeCompte, 1999; see Appendix C for interview protocols). J. W. Creswell

(2005) states that an advantage of interviews are "that they provide useful information when you cannot directly observe participants and they permit participants to describe detailed personal information" (p. 215). The interviewees had the opportunity to respond to 12 questions (see Appendix C). Each of the items corresponded to one or more of the study's research questions. For example, one interview question asked, "Please share what professional development activities you have provided for general education teachers and what specific steps you would take to promote and encourage continued professional development in the area of assistive technology." This item corresponds to the first research question which asks, "What knowledge and skills do general education teachers perceive would facilitate their use of assistive technology in inclusive settings?"

Focus Groups

In addition to the surveys and semi-structured interviews, the researcher conducted two 60-minute focus groups (see Appendix B for focus group protocol). The researcher decided to conduct the focus groups after the surveys and seven interviews because the focus groups allowed for the triangulation of survey, interview, and focus group data, especially for issues that needed more clarity after the interviews (Morgan, 1988). Morgan (1988) argues that "the hallmark of focus groups is the explicit use of the group interaction to produce data insights that would be less accessible without the interaction found in the group" (p. 12).

The focus groups participants had the opportunity to respond to 12 questions. (See Appendix B)Each of the items corresponded to one or more of the study's research questions. For example, one focus group question asked, "As a general education

teacher, how prepared are you to make accommodations using AT for students with LD? If you were recommending training in AT, what would it include?" This item corresponds to the first research question which asks, "What are the experiences of general education teachers regarding the selection and implementation of AT devices in inclusive settings?"

Data Collection

After obtaining formal approval from the Institutional Review Board (IRB), a copy of the IRB (see Appendix C) approval notification and approved materials was sent to the school district. The researcher made contact with school administrators for each of the four secondary schools within the district via email. The email explained the nature of the study, provided invitation letters for participants, and made request for specific dates and times to distribute the survey to the staff and to conduct interviews and focus group sessions. The recording from the focus group and interviews will remain with the researcher as well as hard copies of complete surveys; and once all the information is analyzed, the original recordings and surveys will be destroyed.

Survey

Once each school reserved a date the researcher administered all of the surveys during a regular scheduled staff or grade level meeting. The researcher provided an introduction to the study and time was given to participants to read the consent form. Once the consent form has been read and signed, the researcher distributed the surveys to each participant. The surveys were disseminated and collected on the same day.

Completed surveys were handed directly to the researcher upon completion. The survey took between 30 and 40 minutes to complete.

Focus Groups

Once each school reserved a date the researcher conducted the focus groups during a time appointed by the school administrator. The researcher provided an introduction to the study and time given to participants to read the consent form. Once the consent form had been read and signed, the researcher began recording the focus group session. The focus group interview recordings were loaded into a digital voice program so participants' verbatim responses to the questions could be transcribed into Microsoft Word. Once the focus group was complete the researcher thanked each participant and ended the recorded session. Each focus group lasted between 1 to 1 ½ hours.

Interviews

Once each school reserved a date, the researcher conducted the interviews during a time appointed by the school administrator. The researcher provided an introduction to the study and time was given to participants to read the consent form. Once the consent form had been read and signed, the researcher began recording the interview with each participant. The interview recordings were loaded into a digital voice program so participants' verbatim responses to the questions could be transcribed into Microsoft Word. The participants had the opportunity to answer 13 questions. Once the interview was complete, the researcher thanked each participant and ended the recorded session. Each interview lasted between 1 and 1 ½ hours.

Data Analysis

Data analysis is important to this study because it provides a lens through which the researcher could to determine teacher perceptions of AT usage (Hatch, 2002). Since this study is a mixed-methods design the data were analyzed in two formats. The quantitative data were analyzed by using frequencies and percentages and by calculating means and standard deviation from the items that are included on the survey instrument. Qualitative analysis seeks to uncover categories, patterns, and themes that may emerge out of qualitative data collected in various ways (J. Creswell, 2009). The qualitative data were analyzed by the participants' responses to the focus groups. The researcher made use of Cronbach's coefficient alpha to calculate reliability for scaled items of the survey. A second coder, unfamiliar with the study, was used to secure inter-reader reliability for the focus group, interviews, and open-ended survey questions.

Quantitative Analysis

The statistical analysis program used to was IBM's Statistical Package for the Social Sciences version 20.0 (SPSS). Descriptive data (percentages, means, and standard deviations) for all sampled teachers were calculated for each of the individual survey items as well as group comparisons using an independent *t*-test. The data analyses are organized into two main sections. In section one, quantitative evidence with regard to the reliability and validity of the survey instrument is analyzed and reported. The second section presents detailed statistical analysis for results related to the survey instrument.

Qualitative Analysis

All qualitative data analysis methods involved coding data into themes, and then categories, to form conclusions (Carey, 1995; Miles & Huberman, 1994). Participants' responses to the open-ended question on the survey, responses during the focus groups, and responses during the interviews were analyzed to uncover any themes in their replies. The researcher transcribed participants' responses verbatim, including incomplete thoughts, half-finished phrases, and other characteristics of the spoken word from the group discussion. The researcher did not edit the text to increase readability in order to preserve the character of the actual focus group conversations. A three-part method suggested by Huberman and Miles (1984) was used to analyze the survey, focus group, and 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 irrelevant or repetitive words in their replies. In the second step, data display, the reduced replies for each response were organized using Microsoft Office and examined for similarities. In the third step, themes in the participants' responses were identified. A theme was considered when three or more participants expressed the same concern, explanation, or other comment in their replies to a survey, focus group, or interview question (see Table 1).

Table 1

Research Question Matrix and Data Sources

Research Questions	Data Sources		
	Survey	Interviews	Focus Groups
What are the experiences of general education teachers regarding the selection and implementation of AT devices in inclusive settings?	x	x	x
How do general education teachers perceive the use of Assistive Technology by students with LD?	x	x	x
What knowledge and skills do general education teachers perceive would facilitate their use of assistive technology in inclusive settings?	x	x	x
What do general education teachers perceive as constraints that affect assistive technology implementation?	x	x	x

Summary

This chapter included an explanation of the research methodology used in this study. First, research questions were identified, the participant selection process described, and as explanation provided with respect to how these questions were addressed using both quantitative and qualitative methods. Next, the chapter provided an explanation of the data collection and instruments used in the study, followed by step-by-step procedures used to analyze the qualitative and quantitative data. The results of these analyses are reported in Chapter IV.

CHAPTER IV

RESULTS

The rapid increase of learner diversity means teachers need knowledge and skills to adapt learning for students with a range of individual differences (Kurtts, Dobbins, & Takemae, 2012). In order to promote accountability for students with disabilities, both IDEA and ESEA encouraged the use of assistive technology (Demski, 2008; Edyburn, 2003b; H. P. Parette, Peterson-Karlan, Wojcik, & Bardi, 2007). Although "assistive technology allows students with learning disabilities to accomplish educational goals that they could not accomplish otherwise in the same amount of time or in the same manner" (Rapp, 2005, p. 193), it is widely underutilized (Mavrou, 2011). Given the charge to make effective instruction available to all students, future research must explore the effectiveness of assistive technology integration within secondary classrooms. Many of the past studies have looked at effectiveness of assistive technology, but there is a need to research secondary teacher's perceptions of assistive technology use. The purpose of this study was to investigate the beliefs and attitudes of secondary teachers toward assistive technology use for students with learning disabilities.

This chapter presents the results of the study. The chapter is divided into four main sections. The first section presents the results of the pilot study and explains how the final number of participants for the main study was determined. The second section presents demographic results and quantitative results of the study based on the responses

of participants to the self-administered survey about assistive technology. The third section presents qualitative results from face-to-face interviews with special education teachers and principals and focus groups with general education teachers. In the final section, a summary of the results is presented.

Results of the Pilot Study and Participants

Results of the Pilot Study

A pilot study was conducted to ensure that the self-administered survey format would work properly. In the pilot study, secondary teachers from the Rowan County schools in the state of North Carolina were selected based on their teaching experience with students who had a learning disability. Forty-nine participants took part in the pilot. Each participant was asked to provide the researcher with suggestions and comments related to the validity (appropriateness of the items to assess the information requested) and clarity (understandability of the wording of the item and the directions). Based on the feedback, the survey was revised in order to be used for this study. The changes that were made related to grammar, mechanics, and the numbering of one item. Additionally, the researcher used Cronbach's Alpha to determine the reliability (internal consistency) of the three subscales of the survey. The results showed considerable consistency in responses to the 34 items from each of the three sub scales, with Cronbach's Alpha equaling (.89), (.92), and (.80), respectively. Based on the results of the Cronbach's Alpha, one of the items was rewritten in the supports and barriers section and one item was deleted from the supports and barriers section.

Participants

A total of eight schools in Hoke County agreed to take part in the study and allow secondary teachers who instruct students with learning disabilities to be surveyed, interviewed, and participate in focus groups. After informing the principals about the study, the total number of secondary teachers who consented to complete the self-administered survey was 110; ten of these teachers agreed to be a part of two separate focus group sessions. Eight special education teachers and four principals agreed to participate in an interview with the researcher

Demographics

The majority of survey respondents identified themselves as female (*n* = 89; 80.91%) compared to 19 (17.27%) who identified as male. Two participants did not respond to the gender item. Of the 110 responses to the item regarding education, participants with a Bachelor's degree totaled 64 (58.18%) and outnumbered those with a post-graduate degrees (*n* = 45; 40.91%). In response to the item regarding number of years teaching, the largest group, with 44 respondents (40%) indicated they had taught fewer than five years. Out of 110 participants, over half (*n* = 58; 52.73%) indicated they had fewer than five years of experience teaching students with LD and using assistive technology. Seventy-one percent of teachers reported teaching at least one or more inclusion classes during the current school year. A summary of the demographics for the teachers is shown in Table 2. The majority of survey respondents indicated they held certification in English, math, science, or social studies. These results are summarized in Table 3.

Table 2

Gender, Education, Years of Experience, and Current School Year Classes

Question Item	*n*	%
Gender		
Female	89	80.91
Male	19	17.27
No response	2	1.82
Education		
Bachelor's	64	58.18
Doctorate	3	2.73
Master's	42	38.18
No response	1	0.91
Number of Years Teaching		
10 to 20 years	22	20.00
5 to 9 years	32	29.09
Less than 5 years	44	40.00
More than 20 years	12	10.91
Years Teaching Students with LD		
I have never taught an inclusion class that include student's with LD	2	1.82
10 to 20 years	13	11.82
5 to 9 years	29	26.36
Fewer than 5 years	58	52.73
More than 20 years	5	4.55
None	1	0.91
Years of Experience using AT		
10 to 20 years	11	10.00
5 to 9 years	20	18.18
fewer than 5 years	58	52.73
no response	5	4.55
none	16	14.55

Table 2 (Cont.)

Question Item	*n*	%
Inclusion Classes Taught during current School Year		
0	31	28.70
1	36	33.33
2	15	13.89
3	18	16.67
4	4	3.70
5	4	3.70

Table 3

Teacher Certification

Certification Area	*n*	%
English	24	21.82
English; French; Reading	1	0.91
English; social studies	2	1.82
English; social studies; Special Education	1	0.91
English; Theatre Arts	1	0.91
elementary education	1	0.91
k-6	1	0.91
math	23	20.91
math; English; social studies	1	0.91
math; science	1	0.91
math; social studies	1	0.91
math; English; science; social studies; AIG; principal; Guidance counselor	1	0.91
math; science; middle grades education	1	0.91
no response	2	1.82
science	19	17.27
science; EC	1	0.91
science; health	1	0.91
science; physical education	1	0.91
science; social studies	4	3.64
science; social studies; AIG	1	0.91
social studies	22	20.00

Quantitative Results

The self-administered survey consisted of three subscales which were used to answer the research questions: usage of assistive technology, teacher attitudes and beliefs about assistive technology, and supports and barriers to assistive technology.

Subscale 1: Usage of Assistive Technology (UAT)

This subscale measured teachers' ability to select and implement AT devices to use in class for students with learning disabilities. The subscale was made up of five items employing a four-point scale ranging from strongly agree to strongly disagree. Four items were stated positively; one was stated negatively. In order to analyze the research questions quantitatively, responses were transformed into a four-point numerical scale. For all positive items (8, 10, 11, & 12), strongly agree = 4; agree = 3; disagree = 2; and strongly disagree = 1. The negative items were reverse scored so that the responses would calibrate with the positive items. Thus, for the negative item (9): strongly disagree = 4; disagree = 3; agree = 2; and strongly agree = 1. Cronbach's alpha was used to measure the internal consistency reliability for this subscale. The reliability analysis resulted in a Cronbach's alpha score of .81, which indicates acceptable agreement among the responses to the five items of the UAT subscale.

The percentage distributions, means, and standard deviations for all sampled teachers were computed for each of the individual survey items reflecting teacher usage of assistive technology. The results are shown in Table 4. The overall mean for the subscale was 2.67 with responses ranging from 2.54–2.90. More than 50% of the participants indicated by marking agree or strongly agree that they were engaged in AT

practices such as providing input on the selection of assistive technology devices during IEP meetings (63%), initiating AT usage apart from IEP team recommendations (56.3%), differentiating instruction (81.2%), using AT during co-taught classes (73.7%), and maintaining AT of devices (65.4%). Table 4 summarizes the participants' responses to their usage of assistive technology.

Table 4

Number of Responses, Percentage Distribution, Means, and Standard Deviations for Usage of Assistive Technology Subscale (N = 110)

	Survey Items	Percentage					*M*	*SD*
		SA	A	SD	D	NR		
8.	Special education teachers offer me assistance in implementing appropriate assistive technology for students with LD in my class	15.5	58.2	4.5	17.3	4.5	2.75	.930
9.	I only use assistive technology devices after recommendations from the IEP team.	5.5	33.6	12.7	43.6	4.5	2.54	.944
10.	I provide input on the selection of assistive technology devices during IEP team meetings	7.3	55.5	4.5	28.2	4.5	2.56	.872
11.	I differentiate a lesson by incorporating assistive technology.	17.27	64.55	0	13.64	4.5	2.90	.845
12.	I maintain the assistive technology devices that my student(s) and I use.	11.8	53.6	2.7	26.4	5.5	2.63	.925

Note. SA=strongly agree, A=agree, SD=strongly disagree, D=disagree, NR=no response

An independent sample *t*-test was used to test the null hypothesis that there was no mean difference in usage of AT between general education teachers who have taught for fewer than five years and those with more than 10 years of teaching experience. The results are displayed in Table 5. Of the 110 teachers surveyed, 44 respondents taught for fewer than five years compared to 66 respondents who had taught more than 10 years. Results from an independent *t*-test, with equal variances assumed, revealed no significant difference in AT due to years of experience ($t(108) = .590$, $p = .556$).

Percentages for all sampled teachers were computed for item 13 in which teachers were asked to mark the types of AT devices they used for students with learning disabilities. The list consisted of commonly used types of assistive technology for reading, writing, mathematics, listening, and organization/memory for students with learning disabilities. The results are shown in Table 6. Several teachers reported not using many of the devices listed with the exception of large-print material. Of the 110 participants 55% reported using large print materials as an assistive technology resource. Table 6 shows the percentages of teachers who reported using one or more of the listed AT devices.

Table 5

Group Comparisons and Independent *t*-test for Usage of Assistive Technology Subscale

Subscale	Teachers	*n*	*M*	*SD*	*t*	*p*
Usage of AT	More than 10 years	66	13.24	3.79	.590	.556
	Less than 5 years	44	13.63	2.79		

Note. *n* = number of participants, *M* = Mean years of experience, *SD* = standard deviation, *t* = *t*-test, and *p* = significance

Table 6

Response to Survey Item 13 (N = 110)

Item	#Yes (%)	#No (%)
Reading		
Audiotaped/CD books	36 (32.7)	74 (67.2)
Electronic books (Nook, iPad, Daisy Reader, Kindle, etc.)	36 (32.7)	74 (67.2)
Reading Pen	1 (.91)	109 (99.9)
Changes in background color	31 (28.1)	79 (71.8)
Screen magnification software	25 (22.7)	85 (77.2)
Large print material	60 (54.5)	50 (45.5)
Changes in spacing of words	13 (11.8)	97 (88.1)
Screen readers (This program scans the text and converts the written text into spoken language via speech synthesis)	3 (2.7)	107 (97.2)
Writing		
Word processor	44 (40)	66 (60)
Spell checker	44 (40)	66 (60)
Proofreading programs	14 (12.7)	96 (87.2)
Outlining/“brainstorming” programs	25 (22.7)	85 (77.2)
Voice recognition software	4 (3.64)	106 (96.3)
Screen reading programs	1 (.91)	109 (99)
Word prediction programs	6 (5.4)	104 (94.5)
Slant board	-	110 (100)
Keyguard	4 (3.6)	106 (96.3)
Alternative keyboard	2 (1.8)	108 (98.1)
Pencil grip	14 (12.7)	96 (87.2)
Adapter paper (bold line, raised line, different paper)	9 (8.1)	100 (91.8)

Table 6 (Cont.)

Item	#Yes (%)	#No (%)
Tape recorder for note taking	17 (15.4)	93 (84.5)
Electronic spell checker without auditory output	5 (4.5)	105 (95.4)
Mathematics		
Talking calculator	1 (.91)	109 (.99)
Conventional calculator	34 (30.9)	76 (69)
On-screen (computer-based) calculator	29 (26.3)	80(73.6)
Graph paper	41 (37.2)	69 (62.7)
Calculation chart	14 (12.7)	96 (87.2)
Software with template for math computation	5 (4.5)	105 (95.4)
Listening		
Conventional tape recorder/player	14 (12.7)	96 (87.2)
FM amplification device	16 (14.5)	94 (85.4)
Laptop for note taking	26 (23.6)	84 (76.3)
Organization/Memory		
Personal data managers (standalone)	12 (10.9)	98 (89)
Personal data organization software	6 (5.4)	104 (94.5)
Free-form database	1 (.91)	109 (99)
Calendar programs	10 (9)	100 (90.9)
Tape recorder/player	11 (10)	99 (90)
Index cards	44 (40)	66 (60)
Highlight text with markers or tape	48 (43.6)	62 (56.3)
Color-coded folders or index tabs	22 (20)	88 (80)
Graphic organizer worksheets	42 (38.1)	68 (61.8)
Electronic organizer (Palm Pilot)	5 (4.5)	105 (95.4)
Software for organization of ideas (Kidspiration/ Inspiration)	6 (5.4)	104 (94.5)

Subscale 2: Teacher Attitudes and Beliefs about Assistive Technology (TAB)

This subscale was intended to measure teachers' perceptions of assistive technology use for students with learning disabilities. The subscale was made up of 12 items employing a four-point scale ranging from strongly agree to strongly disagree. In order to analyze the research questions quantitatively, responses were transformed into a four-point numerical scale. For all positive items (14, 15, 16, 17, 18, 19, 24, & 25) strongly agree = 4; agree = 3; disagree = 2; and strongly disagree = 1. Prior to conducting the analyses, the negative items were reverse scored so that the responses would calibrate with the positive items. For the negative items (20, 21, 22, & 23) strongly disagree = 4; disagree = 3; agree = 2; and strongly agree = 1. Cronbach's alpha was used to measure the internal consistency reliability for this subscale. The reliability analysis resulted in a Cronbach's alpha score of .91, which indicates acceptable agreement among the responses to the 12 items of the TAB subscale.

The percentage distributions, means, and standard deviations for all sampled teachers were computed for each of the individual survey items reflecting teacher perceptions of assistive technology and are shown in Table 7. More than 80% of general education teachers indicated they had positive perceptions (responded by marking agree or strongly agree) about the use of AT in their classroom such as: placing importance on the availability of AT in class (82%), acknowledging AT enables student to access the curriculum (90%), as well as considering the use of AT as a method of academic success (85%).

Table 7

Number of Responses, Percentage Distribution, Means, and Standard Deviations for Teacher Attitudes and Beliefs about Assistive Technology Subscale (N = 110)

Survey Items	Percentage					*M*	*SD*
	SA	A	SD	D	NR		
14. When deciding on assistive technology for a specific student, the IEP team considers the student's needs more than the ready availability of a specific device.	10.91	62.7	1.8	17.2	7.2	2.68	.957
15. The availability of AT devices for students with LD is important in my class.	16.36	65.4	1.8	10.0	6.3	2.83	.934
16. Assistive technology devices are useful for all core academic classes.	33.6	60.9	0.91	2.73	1.8	3.23	.715
17. Assistive technology enables students with LD to access the curriculum more readily.	28.1	61.8	1.8	4.5	3.6	3.09	.851
18. AT devices help student with LD learn more readily in my class.	18.8	68.1	1.8	6.3	5.4	2.91	.899
19. General education teachers should use AT in the regular education classroom.	27.2	67.2	0.0	2.7	2.7	3.16	.723
20. Only special education teachers should implement assistive technology for students with LD in resource classes.	0.0	12.7	24.5	60.0	2.7	3.03	.789
21. Using assistive technology slows the pace of learning for the entire class.	1.8	19	16.3	60.0	2.7	2.85	.810
22. AT can cause disruptions in the classroom.	0.0	35.4	10.0	50.9	3.6	2.63	.809
23. The use of assistive technology makes students reliant on the tool and negatively affects their skill development.	0.0	20.9	8.1	69.0	1.8	2.81	.652
24. Overall, assistive technology devices help students with LD complete their assignments in my class.	10.9	71.8	0.0	10.9	6.3	2.80	.872
25. I have seen students make academic progress because of their use of assistive technology.	19.0	66.3	1.8	6.3	6.3	2.90	.947

Note. SA = Strongly Agree, A = Agree, SD = Strongly Disagree, D = Disagree, NR = No Response, *M* = Mean, *SD* = Standard Deviation

An independent sample *t*-test was used to test the null hypotheses that there was no mean difference in usage of AT between general education teachers who teach English and those who teach math. Of the 110 teachers surveyed, 24 respondents taught English and 23 taught math. Results from an independent t test with equal variances assumed produced a t (45) = 1.007, p = .319. There was no significant difference found between English and math general education teachers. Their respective means and standard deviations are shown in Table 8.

Table 8

Group Comparisons and Independent *t*-test for Usage of Assistive Technology Subscale

Subscale	Teachers	*n*	*M*	*SD*	*t*	*p*
Usage of AT	English	24	13.54	3.62	1.007	.319
	Math	23	12.52	3.30		

Note. *M* = Mean of English and Math teachers use of AT

Subscale 3: Supports and Barriers to Assistive Technology (SAB)

This subscale measured the types of supports and barriers for teachers when implementing AT for students with learning disabilities. The subscale was made up of seven items employing a four-point scale ranging from strongly agree to strongly disagree. In order to analyze the research questions quantitatively, responses were transformed into a four-point numerical scale. For all positive items (26, 27, 29, 31, & 32) strongly agree = 4; agree = 3; disagree = 2; and strongly disagree = 1. The negative items were reverse scored so that the response would calibrate with the positive items. Thus, for the negative items (28 and 30) strongly disagree = 4; disagree = 3; agree = 2;

and strongly agree = 1. Cronbach's alpha was used to measure the internal consistency reliability for this subscale. The reliability analysis resulted in a Cronbach's alpha score of .76, which indicates acceptable agreement among the responses to the seven items of the SAB subscale.

The percentage distributions, means, and standard deviations for all sampled teachers were computed for each of the individual survey items reflecting supports and barriers in regards to assistive technology and are shown in Table 9. General education teachers indicated they had positive perceptions (responded by marking agree or strongly agree) about the use of AT in their classroom, such as placing importance on the availability of AT in class (82%), acknowledging AT enables student to access the curriculum (90%), as well as considering the use of AT as a method of academic success (85%). More than 50% of general education teachers indicated the following as restraints (responded by marking agree or strongly agree) to using AT in their classrooms: lack of a technology specialist (79%), limited access to resources (74%), and planning with colleagues (75%).

In this section, participants who answered "strongly agree" or "agree" to item 26 were asked to mark all training that applied. Table 10 shows the number of teachers who listed their training experience. Of the 110 responses to item 26 regarding training, 49% of the participants reported receiving adequate training, 45% of the participants reported not having adequate support, and 6.3% did not respond to the question. The responses were totaled for each type of training teachers received. The three primary ways teachers

received training were: informally from a colleague (28); in-service trainings (37) and from a school or agency (17).

Table 9

Number of Responses, Percentage Distribution, Means, and Standard Deviations for Supports and Barriers to Assistive Technology Subscale (N = 110)

Survey Items	Percentage					*M*	*SD*
	SA	A	SD	D	NR		
26. My school provides adequate training in and knowledge of assistive technology for my classroom needs.	9	40	3.6	40.9	6.3	2.41	.942
27. I would use assistive technology more frequently if there were more support from a specialist to help me with problems that arise.	11.8	67.2	0.0	16.3	4.5	2.8	.814
28. I am reluctant to use assistive technology because it frequently does not work correctly.	1.8	17.2	11.8	61.8	7.2	2.69	.964
29. 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.	10.9	62.7	0.0	21.8	4.5	2.75	.826
30. Assistive technology requires too much time to use during class.	0.0	10.9	9.0	73.6	6.3	2.79	0.857
31. I think administrators, special teachers, and parents are helpful when I need help or an explanation of the AT device used for students in my class.	13.6	69.0	2.7	6.3	8.1	2.77	1.0
32. I need more opportunities to collaborate with colleagues in my discipline on how to use assistive technology.	9.0	66.0	0.0	19.0	5.4	2.73	.842

Note. SA=strongly agree, A=agree, SD=strongly disagree, D=disagree, NR=no response, *SD*=standard deviation

Table 10

Teacher Training for AT

Type of Training	Number Responding
In-service training(s) on the general use of assistive technology	18
In-service training(s) on the use of a particular assistive technology product/device	19
Instructional material(s) that came with a particular assistive technology product/device	15
Webinar(s) or other web-based support	15
No initial training on a particular assistive technology product/device, but technical support or coaching after I was already using this product/device	8
Technical support from my school or an agency	17
Informally from a colleague	28
No response	64
Written Reasons	0

Qualitative Results

The following section presents the results of three types of qualitative data: responses from open-ended questions from the survey, responses from face-to-face interviews, and responses from focus groups. Answers to the open-ended question from the survey as well as the responses from the interviews and focus groups were analyzed using a multi-step process (Miles & Huberman, 1994). First, a set of codes was developed by the researcher based on the reading of a subset of answers. Codes were displayed graphically in a color-coded matrix in order to identify issues or themes (Miles & Huberman, 1994). From the codes themes were created by the researcher.

Survey Open-ended Question

Participants were asked to respond to the following open-ended question: *What other comments do you have regarding assistive technology in relation to students with LD in your classroom?* Of the 110 participants who responded to the survey, 24 participants provided comments for the question. Quotes from the answers are included to provide more concrete evidence to support the themes identified. The answers to the question were coded based on the three themes from the subscales.

The responses for question 33 were grouped into three broad themes: usage of assistive technology (three comments), attitudes and beliefs (ten comments), and supports and barriers (ten comments).

Usage of assistive technology. Using AT with students was viewed as important to teachers. A general education teacher commented, "I currently only use low tech items because I just don't know how to operate more nor do my students demand the use of it." Another teacher wrote, "I use assistive technology with other groups of students as well. For example, graphic organizers work well for English language learners."

Attitudes and beliefs. Several respondents referred to seeing the progress and growth of students with learning disabilities as being a benefit of using assistive technology; however, some teachers thought assistive technology may not yield accurate academic outcomes for students. A general education teacher wrote, "AT is always a useful and helpful tool when it benefits the learning of a child."

Another general education teacher wrote:

> I have seen some success with small/limited AT usage, however I have also seen other critical skills take a back seat at the expense of using an AT device. What I mean is that while AT can help in many area, it can lead to the backslide of others if not properly utilized. I feel it is very important to keep students as self-sufficient as possible.

Supports and barriers of teachers. Most teachers commented on barriers they have encountered in regard to assistive technology such as: limited training, limited availability of devices, lack of support from special education teachers and/or technology staff, and limited time to collaborate with colleagues. A general education teacher wrote, "E.C. teachers are so overloaded with a huge case load, they never help students in the classroom, except for graphic organizers, Cornell notes, highlighting (low-tech, free, or low cost) devices. I've never heard of or seen most devices listed for L.D. students (i.e., more money & staffing, please . . . yeah, good luck with that)."

Another general education teacher wrote:

> I just would like to have classes or explanation of how assistive technology could be used better in the classroom before school begins so that I am ready and the tools are readily available. This would in return allow all of my students to succeed together with assistance of all resources available.

Face-to-Face Interviews

Face to face interviews were held with four special education teachers and four principals from schools that included the general education teachers who took the survey. Special education teachers and principals replied to twelve questions related to the usage, knowledge, and barriers of assistive technology of general education teachers at their

school. The interviews lasted from approximately 10 to 15 minutes. Of the eight participants, six were female (four special education teachers; two principals) and two were male (one principal; one assistant principal). The interviews were audio recorded and transcribed. These transcriptions were then examined carefully and analyzed using the three-step procedure explained in detail in Chapter III and briefly at the beginning of this section: data reduction, data display, and theme identification. Within the responses to the twelve open-ended questions, color coding was used to classify comments that expressed similar explanations and ideas among the participants. If three or more interviewees expressed the same comment or idea, that comment or idea was considered to be a theme. Responses were not coded if they did not pertain to the question asked. The themes for the interview questions are identified along with the number of participants expressing the theme in Table 11. From the analysis, three themes emerged. Those themes and examples of supporting data follow.

Table 11

Themes for Interview Questions

Themes	Interview Questions	Number
Access to the Curriculum	Q1. When you visit a classroom, what are the first things you look for as signs that the classroom is an effective learning place for students with learning disabilities?	7
	Q2. How available is technology in your school for student instruction?	6
	Q3. How do you identify the technology needs of students with learning disabilities as it relates to instruction?	4

Table 11 (Cont.)

Themes	Interview Questions	Number
Access to the Curriculum (cont.)	Q5. What assistive devices and technologies have you worked with or are familiar with in the classroom setting (for example, software programs)?	1
	Q8. Give me an example of one of the most frequently types technology in the general education classroom.	3
	Q12. What are your future goals with regard to assistive technology in the general education setting?	2
Necessities for successful integration of assistive technology in general education classrooms	Q2. How available is technology in your school for student instruction?	2
	Q5. What assistive devices and technologies have you worked with or are familiar with in the classroom setting (for example, software programs)?	6
	Q6. Please share what professional development activities/or ideas you have provided for general education teachers and what specific steps you would take to promote and encourage continued professional development in the area of assistive technology	6
	Q7. How dedicated are general education teachers to the idea of integration and use of technology in the classroom?	6
	Q8. Give me an example of one of the most frequently types technology in the general education classroom.	2
	Q9. If you became aware of a general education teacher that is having difficulty integrating assistive technology into their content, what would you do to help?	2
	Q10. What has been your biggest challenge(s) as it relate to technology integration within inclusion classes?	4

Table 11 (Cont.)

Themes	Interview Questions	Number	
		Effective	Ineffective
Necessities for successful integration of assistive technology in general education classrooms (cont.)	Q11. What role do you feel general and special teachers should have in the development of the instructional materials/technology budget?		3
	Q12. What are your future goals with regard to assistive technology in the general education setting?		3
Effective and Ineffective Assistive Technology Practices by General Education Teachers	Q1. When you visit a classroom, what are the first things you look for as signs that the classroom is an effective learning place for students with learning disabilities?	1	
	Q3. How do you identify the technology needs of students with learning disabilities as it relates to instruction?	4	
	Q4. What does the term "assistive technology" mean to you?	8	
	Q5. What assistive devices and technologies have you worked with or are familiar with in the classroom setting (for example, software programs)?	1	
	Q6. Please share what professional development activities/or ideas you have provided for general education teachers and what specific steps you would take to promote and encourage continued professional development in the area of assistive technology	2	
	Q 7. How dedicated are general education teachers to the idea of integration and use of technology in the classroom?		2
	Q9. If you became aware of a general education teacher that is having difficulty integrating assistive technology into their content, what would you do to help	5	
	Q 10. What has been your biggest challenge(s) as it relate to technology integration within inclusion classes?		2

Table 11 (cont.)

Themes	Interview Questions	Number	
		Effective	Ineffective
Effective and Ineffective Assistive Technology Practices by General Education Teachers (cont.)	Q11. What role do you feel general and special teachers should have in the development of the instructional materials/technology budget?	6	

Theme # 1: Access to the curriculum. A theme that emerged from the interviews in terms of the ways in which general education teachers provide technology during instruction was related to access to the curriculum. Each of the responses fit into the larger theme of an environment that includes differentiated instruction, provides technology, and supports interaction between the teacher and students. Of the twelve interview questions, twenty-three comments were provided by the interviewees concerning access to the curriculum in questions (#1, #2, #3, #5, #8, and #12; see Table 11). Among descriptive statements recorded, the following attributes of accessibility were noted: *classroom environment* (#1, interviewee 1); "I look for the setting up of the classroom, if they're in groups, single rows, if there are computers available, smart boards that perhaps the teacher can use to give some instructions to the students with learning disabilities"; *availability of resources* (# 2, interviewee 6), "There is no excuse in our school for not having the tools that you need? It's all available. All of our classrooms have smart boards"; *Student engagement* (#3, interviewee 3), "I look at preferred learning styles for students where they're auditory, visual learners, multi kinesthetic learners and see what is. I observe them and I also interview students for their

preferred method of receiving instruction"; *differentiated instruction* (#12, interviewee 3) noted:

> I'm always looking for anything that will help increase the learning curve for students with special education because I know they need that, so I'm looking to see how they can be integrated during the regular routine of the classroom without having the student to standout as being different from the other students.

Theme #2: Necessities for successful integration of assistive technology in general education classrooms. Another theme that emerged identifies provisions that teachers must have in order to successfully implement assistive technology in general education classrooms. Of the twelve interview questions, thirty-four comments were provided by the interviewees concerning essential requirements for successful AT integration in questions (#2, #5, #6, #7, #8, #9, #10, #11, and #12; see Table 11). Among descriptive statements recorded, three comments stated teacher awareness of the needs of students with learning disabilities was necessary.

> I have mentored regular educators in the needs of special education students so that they can differentiate instruction and show them how to use it from across different grade levels and gain the same concept using the technology that's been available in the school and showing them how to differentiate their instruction (#6, interviewee 2)

> We have to figure out what's going to be better for our kids, how can we best serve our kids and right now technology and assistive technology is one of those ways especially with our kids with learning disabilities. (#7, interviewee 4)

> I think general education and special educators should be an integral part of the team because they are really the ones that have the day to day instruction utilizing that resource with students and they have first-hand information. (#11, interviewee 3)

Some interviewees mentioned professional development as a necessity for successful integration of AT.

> Some of our teachers, general education teachers may not be as technology savvy because of them being here for years, but because of those technology academies, because we go to the conferences we are able to learn new ways to integrate technology in our classrooms. So really they have to be dedicated and I really feel here at (?) that they're on board for it, 'cause we're learning new and inventive ways to get our kids, our students to learn. (#7, interviewee 6)

> Basically, you know, just continue to build the technology. Continue to get the teachers trained. (#12, interviewee 2)

> My goals, um, probably learning more, seeing what more resources I can get, like software is my weakness right now. Now knowing the software, what software is out there for the students, what works best for the students that I have in my classroom. That's my goal to work on is to find the software for our students that works best for them. (#12, interviewee 4)

Another necessity that was cited was having appropriate access to resources, time to plan, and funding.

> The biggest challenge is we don't have the budget to be able to buy what we'd like to have. You know, we'd like to have a lot more iPads, we'd like to have a lot more desktops, maybe some laptops, but the budget would be the biggest challenge. (#10, interviewee 2)

> I would like to see students, our students, our responsible students, set an example with possibly iPads with keyboards that they can carry around. (#12, interviewee 1)

> Well there's a lot of staff development offered in the district that's free. The only thing that you have to do is give your time, after school, sometimes on Saturday, but mainly you know, after school. It's also something to where, sometimes during our monthly faculty meeting I'll bring in someone from technology. (#9, interviewee 2)

> The biggest challenge we have is not enough. Not having enough iPads or everyone can't work on a smartboard. Not having enough laptops or enough six

> packs in the classroom where everyone is ready and available for all of our students. So that's our biggest challenge, is having enough. (#10, interviewee 4)

Theme #3: Effective and ineffective assistive technology practices by general education teachers. Of the 30 comments provided by the interviewees concerning assistive technology practices, 27 expressed characteristics of effective AT practices and four expressed characteristics of ineffective AT practices in questions (#1, #3, #4, #5, #6, #7, #9, #10, and #11; see Table 11). Effective AT practices are visible when student support is at the forefront of instruction

> As a county that there is a need for technology because the way that the school system is geared toward 21st century learners. So we are making sure that the needs are being met by ordering the iPads by making sure the smartboards are in the classroom, making sure that the students have the TIA (?) 3s, not only have them but know how to operate them correctly. (#3, interviewee 4)

> Well we put technology for all students. Last year we conducted a teacher academy for technology that was on Saturday, we had two for all teachers so they could incorporate technology into daily instruction. Because that's part of our school improvement plan, that we want students to be globally competitive, in order to do that we want to make sure that students are receiving technology in the classroom (#3, interviewee 6)

> Assistive technology is any device that other than the regular instruction that aids the learning and gaining and awareness and learning concepts. It may be as simple as tape recorders or anything such as earphones up to smartboards, computers, iPads, iPods. Whatever is needed to help them grab the concept and that's going to increase their gaining more knowledge. (#4, interviewee 3)

> I know assistive technology for special education students and money is there. So I will fight and a lot of the teachers I work with will, if we have to, we will fight for it. We fought for laptops for kids to have in the rooms. (#11, interviewee 1)

Effective assistive technology practices work best when collaboration is maintained

> I would offer my services on an individual basis, not in the middle of her instruction, but I would do pre instructional type activities so that she can get comfortable with the technology and then implement that and be willing to co-teach using the strategies and technology in the classroom. (#9, interviewee 3)

> Each grade level has a PLC and they get a chance to discuss amongst one another how they're using it and you know, if they did need to see it being used during their planning period they can always go to another grade level and see it being used. The staff that we have on board are always willing to work with one another. (#9, interviewee 7)

> I guess I would, well I've done this before is, I just have to sort of observe the teacher, and see what their skill level is, assess are they resistant to change? You know, I need to find out where they come from because they might just be a little nervous. . . . I would go in and assist with whatever I need to do to help him get it done. Because it's important for the student, but it's also important for the teacher (#9, interviewee 1)

Ineffective assistive technology practices are visible when teachers are reluctant to use technology when they are not comfortable.

> I've been working with the teachers . . . to promote and to encourage them to work with the assistive technology. (#6, interviewee 1)

> I've noticed a lot of general ed teachers that kind of like, fearful, or they balk at any kind of assistive technology that for instance will, they think, that's individual like, the, anything, or the hearing devices, speech, when they have to wear the speech and the microphone, they don't too much like that. They look in terms of whole group instruction. . . . in terms of learning what a child needs based on their individual needs, if they don't understand that individual need, it pretty much scares them. . . . they need training for EC (#7, interviewee 5)

> A lot of my teachers think that students with disability are not ready for the technology because they feel they so behind on the grading level. But I don't see that being an issue because the kids use technology everyday outside of school.

> But teachers look at that as far as saying the students are behind. (#10, interviewee 6)

> The biggest challenge with the technology integration would be with teachers that don't understand. . . . Well, if I give it to this student, then all the students will want it. Well, maybe they will, maybe they won't. So let's just give it a try. (# 10 interviewee 1)

Focus Groups

Two focus groups were held with ten general education teachers (8 session one; 2 in session two. The second session had a lower number of participants because teachers did not show up during the scheduled time. The teachers replied to twelve questions related to the usage, knowledge, and barriers of assistive technology. Focus group question number three was omitted in the analysis because many of the participants answered the question when the researcher asked question one and two. The focus groups lasted from about 20 to about 45 minutes. No demographic information was taken for the two sessions. The focus groups were audio recorded and transcribed. These transcriptions were then examined carefully and subjected to the three-step procedure explained in Chapter III: data reduction, data display, and theme identification. Within the responses to the twelve questions, color coding was used to classify comments that expressed similar explanations and ideas among the participants. If three or more participants expressed the same comment or idea, that comment or idea was considered to be a theme in replies to the question. Responses were not coded if they did not pertain to the question asked. The themes for the focus group questions will be identified along

with the number of participants expressing the theme in Table 12. From the analysis, three themes emerged. Those themes and examples of supporting data follow.

Theme #1: Access to the curriculum. A theme that emerged from the focus group in terms of the ways in which general education teachers provide technology during instruction was related to access to the curriculum. Of the twelve interview questions, thirteen comments were provided by the participants concerning access to the curriculum in questions (#1, #2, #4, #7, and #12; see Table 12). Among descriptive statements recorded, the following attributes of accessibility were noted: *availability of resources* (#2, group 1); "technology is something they may not have at home, whereas we have it here." *Student engagement* and *differentiated instruction* was also mentioned as ways to help students access the curriculum

> I don't know, when I first thought of assistive technology I thought it was things to help students that had hearing, vision disabilities. . . . most of my classes were students with learning disabilities everything I use in that classroom is something to help make sure that they understand better. (#1, group 2)
>
> I've been using the iPads that we have at our school to get my kids to read. Because for some reason they'd rather read off the iPads (#2, group 1)
>
> I feel like anything that can help is needed . . . I don't think I go past a classroom that doesn't use some form of technology for their students . . . I feel like if you give a student nowadays some kind of technology, I mean that's what they want nowadays. It's all about tech. (#4, group 2)
>
> I find that anything that I can put in their hand can make their grade jump. If they can have something in their hands whether it be a geo board or a white board, anything. It makes them pay that much more attention. (#7, group 1)

Theme #2: Necessities for successful integration of assistive technology in general education classrooms. Another theme that emerged identifies provisions that

teachers must have in order to successfully implement assistive technology in general education classrooms. Of the twelve questions, thirty comments were provided by the participants concerning essential requirements for successful AT integration in questions (#2, #4, #5, #6, #7, #9, #10, #11, and #12; see Table 12). Among descriptive statements recorded, two comments stated teacher awareness of the needs of students with learning disabilities was necessary.

> I did guided notes for every student. I just decided that maybe it would help if they had it right in front of them, all they really had to do was fill in a blank or two but they had the notes right there written . . . I really felt like it helped and I mean their scores, some kids who had never passed a test in my class got 80's. (#7, group 2)

> If I have a student who has vision and hearing problems, I try and make the notes big enough so that she can see them and so I know everybody else can see them, you know what I'm saying? I feel like if I do it for her or if I do it for one, I might as well do it for them all because it's not like—you know what I'm saying? It's not like it's going to hinder them. (#9, group 2)

Several participants stated professional development as a necessity for successful integration of AT.

> I would like to have had training on the SMART Board because I don't know how to use it to its full potential. To access everything that—like the response thing, I don't even know how to use it. I would have a little bit of that. (#2, group 1)

> I think there needs to be training. There needs to be more training available. I know the younger generation that just graduated; when you were in high school you're getting computer classes. When I was in high school I had typing classes. There weren't even computers in my high school. When I was in college I had a word processor. I never got where they are in college and you're learning to be a teacher, you're getting shown how to use this technology. Where I'm 40 and I'm behind, so I do need the training. I need to know how to use it. (#4, group 1)

> I think there needs to be an increase in the quality of the usage of the technology. Just because you turn your projector on and have something up on the SMART Board and show a video today. That's not using technology, that's having a projector. I don't know if it's the teachers or the county for helping us, but we need to figure out how to use the technology that we have to the best of our abilities every time that we go to use it. Instead of just throwin' something up there and say hey I used the SMART Board today. (#4, group 1)

> I don't know what the protocol is, but rather than like once a semester or once a year. What I'm saying is when I talk about training, because that's something that you just don't go in one time and learn all that needs to be learned. I think it's something that could be—what would be effective is something that even on a monthly or weekly. I've been in systems where there was just a person who that's their job. On a weekly basis there was some lesson that was being triggered or focused on and if you wanted to attend that session and you got credit. (#5, group 1)

> It's like the old adage more is not better. You could have a school system with tons and tons of equipment but if you don't understand how to best utilize that material, it's as if you didn't have anything. (#6, group 1)

Participants also commented on the importance of knowing what types of AT are available.

> We had a parent night and we have a high population of Hispanic kids. I think some parents were in the room that didn't understand what the speaker was saying and then after the meeting was over someone from ESL came to us and told us that there's actually something available for them to be sittin' at the back of the room repeating what the speaker is saying where the parents will have headphones on. They can translate whatever it is that's being said. We never knew that that resource was available. For the first time somebody was sharing that information with us. I think it's an issue with not knowing what's available. (#2, Group 1)

> I think more or less we got to make sure that every teacher knows what's available. I feel that depending on the availability would determine how comfortable each teacher feels. Every teacher that wants to use that type of equipment needs to be trained on it. Until we really know exactly what's available and when the training times are, then we're still gonna be floatin' in the dark. (#6, group 1)

> Knowing what's available and then how best to use what's there. Then once you have maximized that, then move onto other things. (#6, group 1)
>
> Yeah, what can we get? What can we use? I mean yeah we have the SMART Board and the calculators but if there's something else here then I want to know where it is and how to use it and whatever. (#11, group 2)

Finally, the participants noted that having access was necessary for successful integration of AT.

> If we could have more technology people to work on our technology. We have so many people here in Hope County and they give us such an abundance of technology to use, but we don't have enough workers to be able to work on it when it's down. (#2, group 1)
>
> I don't think we have it long enough to see good results. If we had it every day, then we could possibly see or measure how well they're doin' with the technology. Right now we're just waiting on another teacher to finish, trying to put our names on the calendar so that we can get it the next week. It's hard to try to plan and prepare to use the assistive technology in our school, because it's so limited. (#7, group 1)
>
> I'm in a hut, in a learning cottage, and I can't have a full set of iPads all up at the same time. I can only have about six iPads and you can only be up at the very front of the room. That's the draw back. When I schedule to have a class set of iPads, I have to be in here at the media center. Then if students are using their Smartphones or whatever, getting a signal. Three or four of 'em sitting over here in this corner they've got a signal then there they don't. It's those kinds of things, so again going back to the tools are what, but you've got to make sure that you're in an environment that is conducive to receive and utilize these tools. (#11, group 1)
>
> Just like everybody else is saying, make sure everybody has access. The teacher team that I teach with in my content area, we'll plan together and sometimes we might want to do the same lesson and we want to use the iPads. Well we all can't use the iPads so we end up trying to split them up amongst the three of us. Sometimes a lesson like a primary source document because they'd rather do that on an iPad and read than the piece of paper. You can't have three or four students sitting around one iPad. We've found that to be some want to navigate and sometimes that's frustrating for me to incorporate technology when it's hard to access or hard to get my turn or it's gonna put me behind in my lesson. Just

making sure maybe there's enough for each class to make it accessible. I would use it if it was accessible every day. (#11, group 1)

Theme #3: Effective and ineffective assistive technology practices by general education teachers. Of the 32 comments provided by the interviewees concerning assistive technology practices, thirty expressed characteristics of effective AT practices and three expressed characteristics of ineffective AT practices in questions (#1, #2, #4, #5, #6, #7, #8, #9, #10, and #11; see Table 12).

Table 12

Themes for Focus Group Questions

Themes	Focus Group Questions	Number
Access to the Curriculum	Q1. Let's start with your own understanding of assistive technology, how do you define assistive technology?	5
	Q2. If I went out to the schools and asked teachers/specialists how they define assistive technology, what else would I hear?	4
	Q4. How much of a need do you see for assistive technology use to increase or decrease general education classrooms? On what basis are you making your decision?	1
	Q7. In your experiences, what has been student achievement using assistive technology?	2
	Q12. What are some reasons you do not use AT? Reasons you do use AT?	1
Necessities for successful integration of assistive technology in general education classrooms	Q2. If I went out to the schools and asked teachers/specialists how they define assistive technology, what else would I hear?	8

Table 12 (Cont.)

Themes	Focus Group Questions	Number	
Necessities for successful integration of assistive technology in general education classrooms (cont.)	Q4. How much of a need do you see for assistive technology use to increase or decrease general education classrooms? On what basis are you making your decision?	4	
	Q5. To what extent do you perceive administrative support for assistive technology? What type of training would help administrators be better able to foster assistive technology use?	5	
	Q6. If you were in charge on the topic of assistive technology, what would you do to increase assistive technology use schools?	4	
	Q7. In your experiences, what has been student achievement using assistive technology?	1	
	Q9. As a general education teacher how prepared are you to at making accommodations using AT for students with LD needs? If you were recommending training, what would it include?	1	
	Q10. How prepared are EC teachers and other EC staff to increase assistive technology use? If you were recommending training for them, what would it include?	1	
	Q11. What else needs to be shared with your school district decision-makers regarding assistive technology?	5	
	Q12. What are some reasons you do not use AT? Reasons you do use AT?	1	
		Effective	Ineffective
Effective and Ineffective Assistive Technology Practices by General Education Teachers	Q1. Let's start with your own understanding of assistive technology, how do you define assistive technology?	3	
	Q2. If I went out to the schools and asked teachers/specialists how they define assistive technology, what else would I hear?	3	2

Table 12 (Cont.)

		Number	
Themes	Focus Group Questions	Effective	Ineffective
Effective and Ineffective Assistive Technology Practices by General Education Teachers (cont.)	Q4. How much of a need do you see for assistive technology use to increase or decrease general education classrooms? On what basis are you making your decision?	1	
	Q5. To what extent do you perceive administrative support for assistive technology? What type of training would help administrators be better able to foster assistive technology use?	1	
	Q6. If you were in charge on the topic of assistive technology, what would you do to increase assistive technology use schools?	3	
	Q7. In your experiences, what has been student achievement using assistive technology?	1	
	Q8. What is the best example of assistive technology you have seen/heard about? The worst?	5	
	Q9. As a general education teacher how prepared are you to at making accommodations using AT for students with LD needs? If you were recommending training, what would it include?	3	
	Q10. How prepared are EC teachers and other EC staff to increase assistive technology use? If you were recommending training for them, what would it include	7	
	Q11. What else needs to be shared with your school district decision-makers regarding assistive technology?	2	1

Effective AT practices are visible when teachers received assistance from support from curriculum specialist.

> If I had a topic that I didn't know a good way to teach, didn't know a good lab to do, didn't know a way to integrate the technology into that activity. They would

> come in, we would have like a 30 minute discussion about it. Two or three days later they'd come in and teach my first period class. My second period class I would teach with them observing me. They'd give me feedback on planning. Third and fourth period I teach by myself. That worked so well because if I didn't know how to use something that was provided by the school they could say we have this in the media center. Let's pull that in. Because they did know what was available, whereas I may not have. (#5, group 1)
>
> I think it would be nice to actually sit down and be like this is what this means. Especially for new teachers, like we went through our classes in college and everything. I think it's a little different when you actually get into it. (#6, group 2)
>
> Show us what it's supposed to look like. Show us what an example of that is so that—you know what I'm saying? I can understand better. What does that specific student need? (#9, group 2)

Effective assistive technology practices work best when collaboration is maintained.

> Well our EC teachers are always bringing in ideas to our classrooms. If you want to do it this way, so they're always givin' us help, givin' us different ideas to help the kids be more productive. They're technology related; sometimes they're related to making the assignment more easier so kids can comprehend. A lot of times they are technology related. (#10, group 1)
>
> I don't feel that it necessarily is the special ed teacher's, solely the responsibility. I think as a teacher that's a joint effort in instructing the student. If I felt that this would be a tool that would be advantageous for the student. (#10, group 1)

Ineffective assistive technology practices are visible when teachers are reluctant to use technology when they are not comfortable.

> I think sometimes while students are very knowledgeable about the utilization of the tools. I think sometimes, and I'll speak for myself, teachers, there's a hindrance or a draw back because they do not feel completely comfortable in putting something out there when they themselves are not quite sure of how best to use that particular tool to access information. I don't necessarily say that all teachers need the training but I think that it needs to be available on a periodical or regular basis. When teachers do need it they can access—I know there are sites

> online that you can go to, but sometimes in house opportunities are better than going and watching something. I'm speaking for myself. Watching on a screen, and I've done that. When I just felt that I had to have something to assist me to get a understanding. I think when it's on campus or at a place where you can drive and be a part of a setting. I think it's more of an advantage then. That's what I would have to add to that. (#2, group 1)
>
> When it's given they use it, but I don't think they use it to the best of their abilities. I'm not sure if they know how to search websites and get accurate information. There's still a lot of assistance that we have to give them. Letting them do it independently. I'm not sure if the outcome is great if you're gonna get a good product. You still have to assist them and show them exactly what to do. Sometimes they'll use their cell phones, I'm not always sure if they're completing the task. We have to do a lot of monitoring, but when it's offered yes they will use it. How effectively they'll use it, I'm not sure about that. (#2, group 1)
>
> I like technology and I think students have fun, but what I found a few months ago we had iPads and they were doing like a web type quest and I had questions. They had to research the answer. They think if you just put the question in Google and hit search and everybody says I can't find the answer, it's not comin' up. I think they need to learn how to not just go into—back when I was going to school you have to go into a library and look in a book. I think they need the basics as well. The basics like going into a library because sometimes you still have to go look up archives. Not everything's digital anymore, but gettin' those basics will also help them navigate the web and be able to think their way through and read a source and say I don't think that's reliable. Let me do another search to see what I can find. Because they're like Ms. X you don't know what you're doing or the answers not on the internet. I said, "The answer's there, you have to read and figure it out on your own." I mean I'm not saying technology is bad, I think they need to know a little bit more about researching even online or even the old fashioned way. Where you go into a library and look at a book. I think it will help them. (#2, group 1)

Chapter Summary

This chapter reported the results of the self-administered survey, eight interviews, and two focus groups. Results were reported for the self-administered survey. This included reliability analyses of results and the means and standard deviations for responses to items in each of the three subscales, as well as a the number of teachers who

reported using various types of assistive technology in the areas of reading, writing, mathematics, listening, and organization/memory. This chapter also reported the types of training general education teachers received in the area of assistive technology.

The qualitative part of the study consisted of one open ended question at the end of the self-administered survey, eight interviews with special education teachers and principals, as well as two focus groups with general education teachers. Themes of the open-ended question, interview responses, and focus groups were identified for each question, along with the number expressing each theme. Based on these results, the four research questions were addressed and answered. These results and several implications of the study will be discussed in the following chapter.

CHAPTER V

DISCUSSION

Universal Design for Learning (UDL) is an integral part of current conversations related to instructional practices for children with learning disabilities (Basham & Marino, 2013; Shah, 2012; Shaw, 2011). UDL principles reduce barriers in instruction and provide all learners with appropriate support. Efforts to ensure that students with disabilities have access to grade-level materials and appropriate teaching methods, is driven by mandates from the Elementary and Secondary Education Act of 2001 (ESEA), formerly, No Child Left Behind, and the Individuals with Disabilities Education Improvement Act of 2004 (IDEIA). To adequately address these mandates, states are called upon to provide well prepared and effective teachers that understand how to implement UDL principles in their classrooms. Understanding the exceptionalities of special education students will not only require these teachers to effectively implement UDL but, to also have knowledge of specific tools such as, assistive technology to support student learning. UDL, in particular D. H. Rose, Hasselbring, et al.'s (2005) conceptualization of the framework, describes assistive technology and UDL as reciprocal approaches to improving education for students with learning disabilities. Many studies have been completed regarding the positive impact assistive technology has on the academic performance of students with learning disabilities (H. P. Parette, Blum, & Boeckmann, 2009; H. P. Parette et al., 2013; Judge, 2006; Mistrett, Lane, & Ruffino,

2005) yet, few studies have examined secondary teachers' perceptions regarding the use of assistive technology for students with learning disabilities (Alper & Raharinirina, 2006; Bouck, Maeda, & Flanagan, 2012).

This study focused on secondary general education teacher's perceptions of assistive technology use for students with learning disabilities. In order to effectively examine this gap in the literature, data collection for this study consisted of a mixed methods approach. Combining quantitative and qualitative data within a research project presents an opportunity to provide an extensive and in-depth understanding of the data which facilitates a more thorough analysis than studies that are exclusively quantitative or qualitative (R. B. Johnson, Onwuegbuzie, & Turner, 2007). In this study, 110 secondary general education teachers completed a four part survey designed to collect both quantitative and qualitative data. In addition, this study assembled 12 of these general education teachers to participate in two focus groups. Lastly, interviews were conducted with four special education teachers and four principals from the secondary level. These data sources were transcribed and analyzed to produce the findings outlined in chapter four of this study. The following questions were investigated:

1. What are the experiences of general education teachers regarding the selection and implementation of AT devices in inclusive settings?

    Subquestion 1: Is there a significant mean difference of usage of AT between general education teachers who have taught less than 5years and teachers who have taught more than10 years?

Subquestion 2: To what extent are general education teachers using AT for reading, writing, mathematics, listening, and organization/memory? To examine this question

2. How do general education teachers perceive the use of Assistive Technology by students with LD?

    Sub question1: What is the relationship between the number of years teaching inclusion classes and teacher perception of AT for students with LD?

    Sub-question 2: Is there a significant mean difference of AT usage for students with LD between math and English teachers?

3. What knowledge and skills do general education teachers perceive would facilitate their use of assistive technology in inclusive settings?

    Subquestion 1: What are the factors that influence teachers knowledge and skills of AT?

    Subquestion 2: What is the relationship between years of experience using AT and knowledge and skills amongst general education teachers?

4. What do general education teachers perceive as constraints that affect assistive technology implementation?

    Subquestion 1: What are the factors that influence AT use in general education classrooms?

In order to answer the main research questions and subquestions, the results of the data must be interpreted. The subsequent section is a summary of these findings. This will be followed by a discussion, recommendations for future research and the conclusion.

Summary of Findings

Research Question 1

What are the experiences of general education teachers regarding the selection and implementation of AT devices in inclusive settings? This research question focused on the participants' ability to select and use AT devices in their classroom for students who have learning disabilities. The analysis of this data reveals that over half (63%) of general education teachers actively participate in IEP meeting by providing input when selecting AT devices. Additionally, 56% of general education teacher reported using AT even when it was not recommended by the IEP team. Moreover, 73% of participants stated using AT during co-taught classes with the assistance of the special education teacher. Similarly, 81% of the participants in this study agree to the necessity of AT by using it to differentiate instruction. Through the open ended survey question, interview, and focus group responses, participants acknowledge their role in making sure students with disabilities have appropriate access in the general education setting. However, participants stated they were uninformed about the function and purpose of some AT devices which hindered them from effectively employing the devices within their instruction.

Subquestion 1. *Is there a significant mean difference of usage of AT between general education teachers who have taught less than 5years and teachers who have taught more than10 years?* After analyzing the survey data, results from an independent *t*-test, with equal variances assumed, revealed no significant difference in AT due to years of experience ($t(108) = .590$, $p = .556$.) This lack of correlation could be the result of assistive technology practices not being connected to prior beliefs or experiences. According to Bandura (1986) teachers' prior beliefs have an impact on their thinking, information processing, and acquisition of how new knowledge is accepted and integrated into their knowledge base. Furthermore, this outcome could suggest that teachers at all levels in their career were equally able to integrate assistive technology. At the onset of the study, the researcher anticipated that younger teachers would have more experience with assistive technology and be able to use it in their classrooms. Additionally, it is important to note that two focus group participants indicated more training is necessary because there is a gap in technology skills in regard to teachers who recently graduated and those who have been teaching for a number of years.

Subquestion 2. *To what extent are general education teachers using AT for reading, writing, mathematics, listening, and organization/memory?* To examine this question, responses from survey item 13 were analyzed. It was evident that teachers were not familiar with and/or did not recognize the items on the list as AT devices because the majority of participants reported low percentages of using the AT devices on the list with the exception of large print material for reading (63%). In examining the interviews and focus groups data, participants indicated they needed to have more information on the

types of available technology and ongoing professional development on how to use the tools in their classrooms.

The findings for research question one are supported by existing literature that identifies factors that inhibit technology integration in classrooms. Bauer and Kenton (2005) found that teachers were skilled with technology and able to overcome obstacles, but that they did not integrate technology on a consistent basis in their classroom. In their discussion they state, "teachers felt that their own lack of expertise needed to be overcome before they could succeed" (p. 534). Bauer and Kenton (2005) further suggest that schools have not yet achieved true technology integration because teachers are faced with a continuum of obstacles such as training and ongoing professional development.

Similarly, Lawless and Pellegrino (2007) state professional development is critical to ensuring that teachers adapt their teaching to shifting school environments and an increasing diverse student population. They go on to say, "despite national recognition of the importance of teacher professional development, report after report depicts the state of teacher professional development as inadequate" (p. 575). Bauer and Kenton (2005) and Lawless and Pellegrino's (2007) studies provide support for the research findings of this study because in order for these teaches to become more knowledgeable of the promise of technology use for students with learning disabilities they must be adequately prepared to integrate technology so they can facilitate student learning (Anderson, Anderson, & Cherup, 2009).

Research Question 2

How do general education teachers perceive the use of Assistive Technology by students with LD? From the perspective of the participants there were several ways that assistive technology was beneficial for students with learning disabilities. The analysis of the data indicates that of the teachers believe assistive technology should be used in general education classes because it provides access the curriculum, allows students to complete assignments, and supports academic progress. Additionally, the participants believed that assistive technology should be used in all core classes. Participants also indicate that they understand the meaning of assistive technology and are enthusiastic about using assistive technology in their classrooms. One participant explains

> Assistive technology is any device that other than the regular instruction that aids the learning and gaining and awareness and learning concepts. It may be as simple as tape recorders or anything such as earphones up to smartboards, computers, iPads, iPods. Whatever is needed to help them grab the concept and that's going to increase their gaining more knowledge.

Subquestion 1. *What is the relationship between the number of years teaching inclusion classes and teacher perception of AT for students with LD?* After analyzing the survey data, results from an independent *t*-test, with equal variances assumed, revealed no significant difference in the relationship between the number of years teaching inclusion classes and teacher perceptions of AT. This correlation mirrors the data from the first sub question in research question one. The demographic information from question two and five reveals that many participants' level of teaching and assistive technology use was equal.

Subquestion 2. *Is there a significant mean difference of AT usage for students with LD between math and English teachers?* Because the content areas of English and mathematics are different in both concepts and teaching approaches, an analysis of survey responses regarding assistive technology use was conducted. An independent sample t test was used to test the null hypotheses that there was no mean difference in usage of AT between general education teachers who teach English and those who teach math. Results from an independent t test with equal variances assumed produced a t (45) = 1.007, p = .319. There was no significant difference found between English and math general education teachers. The lack of a relationship between AT implementation and usage among core teachers is problematic since these devices are intended to help students to function more effectively in their classroom environments, and presumably improve their academic performance (Lange, McPhillips, Mulhern, & Wylie, 2006).

Research Question 3

What knowledge and skills do general education teachers perceive would facilitate their use of assistive technology in inclusive settings? From the perspective of the participants, training and collaboration with special education teachers are two ways that would facilitate their knowledge and skills of assistive technology. A total of 54 out of 110 survey participants indicate they received adequate training from their schools. However, participants from the interview and focus groups state that specific AT training AT were necessary to increase their knowledge and skills. One participant from the focus group notes, “I would like to have had training on the SMART Board because I don’t know how to use it to its full potential.” A participant from the interview states,

"we're constantly having some type of training. They kind of give us an overview of what the new technology is supposed to do." Furthermore, participants feel collaboration with other teachers would facilitate their knowledge and skills of assistive technology. One participant explains, "I don't feel that it necessarily is the special ed teacher's, solely the responsibility. I think as a teacher that's a joint effort in instructing the student."

Subquestion 1. *What are the factors that influence teachers knowledge and skills of AT?* To examine this question data was taken from the survey, interview, and focus group responses. The majority of participants (49%) reported that training was a major factor that influenced their knowledge and skills of assistive technology. Participants state the following as primary types of training they received in regards to assistive technology; instructional materials included with the device, webinars, coaching or technical support, in-service training, and support from colleagues. Data analysis from the survey also specifies that support from administrators, special education teachers, and parents were another factor that influenced teacher knowledge and skills of assistive technology. Based on the focus group and survey data, participants indicate additional training would facilitate their knowledge and skills as it relates to assistive technology. One participant states, "Until we really know exactly what's available and when the training times are, then we're still gonna be floatin' in the dark."

Subquestion 2. *What is the relationship between years of experience using AT and knowledge and skills amongst general education teachers?* In trying to determine factors that influence teacher's skills and knowledge of assistive technology, this study also sought to understand if there was a relationship between the knowledge and skills of

teachers and their years of experience using assistive technology. Based on the demographic information, 53% of the participants have less than five years of experience using assistive technology. A couple responses from the focus group and interview indicate that teachers are not experienced users of assistive technology because they are uncertain of new technologies, or they are reluctant to use AT. One participant from the focus group states, "I currently only use low tech items because I just don't know how to operate more." Likewise a participant from the interview states, "when we first kicked off technology teacher was very reluctant. I think because they were set in their comfort zone. My new teachers have embraced it and love it; it's the career teachers because they have their own way of teaching had to adjust."

Overall, the aforesaid perceptions of the participants is very relevant to the literature that deals with, the need for teachers to have adequate training (Ault, Bausch, & McLaren, 2013; Bausch & Hasselbring, 2004; Edyburn, 2004; Temple, 2006), and the importance of teacher knowledge of assistive technology devices (Judge, Floyd, & Jeffs, 2008; Marino, Marino, & Shaw, 2006; Puckett, 2004). In terms of collaboration, Bryant Davis, Dieker, Pearl, and Kirkpatrick (2012) state "the bottom line for practice is that general educators and special educators must work in partnership in all aspects of instruction to serve all students" (p. 209). This sentiment by Bryant Davis et al. (2012) captures the participants' perceptions that partnerships with their colleagues are vital to increasing their knowledge and skills of assistive technology practices in the general education setting.

Research Question 4

What do general education teachers perceive as constraints that affect assistive technology implementation? The analysis from the survey data pertaining to this research question reveals three factors that impede teachers from using assistive technology--adequate training, additional support, and more access to resources. A total of 49 out of the 110 surveyed teachers (45%) reported not receiving adequate training for assistive technology. It was also found that 87 out of the 110 survey teachers (79%) stated they would use assistive technology more if they received support from a specialist. Additionally, 81 out of 100 surveyed teachers (74%) reported they needed more access to resources in order to integrate assistive technology into their instruction. Additionally, participants from the focus group and interviews indicate that infrastructure is another barrier in regard to integrating technology. One participant explains, "I'm in a learning cottage, I can only have about six iPads and you can only be up at the very front of the room . . . you've got to make sure that you're in an environment that is conducive to receive and utilize these tools."

Subquestion 1. *What are the factors that influence AT use in general education classrooms?* Participants state that recurrent opportunities to collaborate with colleagues would impact there use of assistive technology. A total of 83 out of 110 surveyed teachers (75%) reported they would need regular planning time with colleagues in regard to effectively using assistive technology within their content. One participant comments, "I would offer my services on an individual basis, not in the middle of her instruction, but I would do pre instructional type activities so that she can get comfortable with the

technology and then implement that and be willing to co-teach using the strategies and technology in the classroom."

The findings from research questions four supports the extant literature which describes factors that impact the knowledge and skills of teachers in regard to technology usage. General education teachers from this study are aware of the accountability measures related to teaching students who have disabilities, but recognize they are not being given time (Temple, 2006), support (Ebner, 2004), adequate training (Bausch & Hasselbring, 2004), or resources (Y. Lee & Vega, 2005) they need in order to provide accommodations such as assistive technology.

Discussion

Based on the results presented in chapter four as well as the summary of results outlined in the previous paragraphs, there is one overarching factor that can be drawn from all four research questions. The findings from this study underscore the importance of professional development, its connectivity to teacher knowledge and skills, as well as how it could increase teacher use of assistive technology. Participants in this study equate their lack of knowledge and limited use of assistive technology to disjointed professional development (Mueller, Wood, Willoughby, Ross, & Specht, 2008). This finding calls attention to the need for professional development that includes specific methods for technology integration (Foon Hew & Brush, 2007; McGrail, 2005), as well as professional development that offers an opportunity for reflective learning (Ertmer & Ottenbreit-Leftwich, 2010). This is especially true since beliefs act as a lens or filter when people process new information (Tillema, 1995). Furthermore, it is necessary that

information delivered through professional development considers, existing knowledge (Zhao & Frank, 2003), self-efficacy (Mueller et al., 2008), and pedagogical beliefs about technology (J. Harris et al., 2009) otherwise, it may be unlikely that teachers will use assistive technology for students with learning disabilities.

Existing Knowledge

Lawless and Pellegrino assert that "technological literacy has fast become one of the basic skills of teaching" (2007, p. 580). In order to use assistive technology to support meaningful student learning, teachers should have a foundational understanding of the varieties and functions of technology. Therefore, it is important to understand teachers existing knowledge. When teachers learn how to use technology within their specific content areas and/or grade levels, they can more readily transfer that knowledge to their own classrooms (Snoeyink & Ertmer, 2001/2002). As evidenced in the data from this study, general education teachers were familiar with the purpose of assistive technology however; their limited use reveals they were conversant with assistive technology on a novice level. Cennamo, Ross, and Ertmer (2010) argue that if teachers are going to use technology with their students, they need to be able to do the following: (a) identify which technologies are needed to support specific curricular goals, (b) specify how the tools will be used to help students meet and demonstrate those goals, and (c) enable students to use appropriate technologies in all phases of the learning process including exploration, analysis, and production (p. 10). By providing professional development that emphasizes the previously mentioned skills and hones in on existing

knowledge, teachers will have the ability to reformulate their perspectives on assistive technology as it relates to instructional practices for students with learning disabilities.

Self-efficacy

Although knowledge of assistive technology is necessary, teachers should also feel confident using that knowledge to facilitate student learning. While the amount of training reported by participants was high, the finding that most of the participants sparingly used assistive technology could validate Brinkerhoff's (2006) notion that the gap between what teachers know and what tasks they successfully carry out relates to their self-efficacy. According to Bandura (1986) an individual's beliefs about their capability of accomplishing a particular task is influenced by the following: past performance, modeling, verbal persuasion, and psychological state. If the training received by teachers in this study did not build on their prior knowledge, did not demonstrate how to integrate technology, and did not set an encouraging tone, this could trigger anxiety or stress causing them to feel incapable of using technology during instruction. Mueller et al. (2008) state that "professional development and the process of technology integration must address the attitudes of teachers and present them with opportunities for positive experiences" (p. 1534). The more experiences teachers have using technology, the more likely they will be comfortable using assistive technology to facilitate learning for students with learning disabilities.

Pedagogical Beliefs

According to Coppola (2004) teaching with technology requires a multifaceted approach to planning, implementation, and evaluation. Although participants in this

study support the notion of using assistive technology they are not prepared to meet the expectations outlined by Coppola (2004). Primarily because their content knowledge and pedagogical knowledge are not in sync with the specific ways in which technology can support those methods. In order for the participants to align their content knowledge, pedagogy knowledge, and technology knowledge Foon Hew and Brush (2007) state that effective professional development for technology integration requires a focus on content that includes: (a) a focus on content (e.g., technology knowledge and skills, technology-supported pedagogy knowledge and skills, and technology-related classroom management knowledge and skills), (b) gives teachers opportunities for ‘‘hands-on’’ work, and (c) is highly consistent with teachers’ needs (p. 238). Similarly, Cohen and Hill (2000) indicate that professional learning can improve academic outcomes if it increases teachers’ understanding of the content they teach. Thus, it is important that professional development programs connect specific grade level and content so teachers do not revert to their traditional way of technology integration.

General educators are accountable for teaching the general curriculum in a manner that benefits students with learning disabilities. To meet the needs of this population, there has been a call for educators to increase the level of assistive technology use in their classes (Lei, 2009) however; responding to this challenge will require professional development that focuses on teachers’ existing knowledge, self-efficacy, and pedagogical beliefs about assistive technology. If teachers receive professional development in this manner their teaching practices will support the principles of Universal Design for Learning (UDL), which advocates for expanding

teaching approaches so that students with disabilities have equal access to classroom teaching and learning (Pliner & Johnson, 2004).

Implications for Practice

In this study and throughout the literature, the idea that technology is not widely used for students with learning disabilities is evident, consequently; there is a need to reshape professional preparation in a way that involves hand-on experiences for pre-service teachers. There is also a need to address the positive impact of on-going professional development for in-service teachers, particularly those in rural settings. The following discussion examines implications for teacher education programs and professional practice.

Teacher Education Programs

Universities and college faculty will need to create innovative and comprehensive strategies through coursework in order to increase pre-service teacher's knowledge of assistive technology. One opportunity to create such awareness is in the area of practice. Pre-service teacher can be engaged with in-class assignments that focus on the various types and uses of assistive technology in methods courses. By introducing assistive technology into a methods class, faculty members can display specific devices that relate to that content area as well as provide hands-on experiences of how to integrate the devices into the curriculum as well help pre-service teachers understand how to develop lesson plans that employ low-tech or high tech devices. Additionally, practicum experiences can also involve assistive technology integration. When pre-service teachers are placed in schools, they would benefit from experiences in general and special

education classrooms where AT is implemented with students who have disabilities. As a follow-up activity they can write reflective journals based on their observations and experiences. As a final point, service learning projects that focus on assistive technology can address needs of individual with disabilities in the local community while developing pre-services teachers' skills of AT use.

Professional Practice

The geographical region for this study was situated in a rural school district that had limited access to resources and teachers who were unaware of various types and uses of assistive technology. Findings from the research in this study suggest that on-going professional development is needed in order for in-service teachers to effectively use assistive technology. Teachers would benefit from a two-part professional development strategy that enables them to (a) understand their existing knowledge, self-efficacy, and pedagogical beliefs about assistive technology as well as (b) opportunities to engage in action research using assistive technology in their classroom.

To explain the second part of the professional development a brief flowchart outline has been developed (see Figure 2). The goal of the flowchart is to streamline the action research process for general education teachers. After teachers have been introduced to the purpose and format of action research they will follow the process.

In step 1, the general education teacher will meet with an AT specialist that has been trained by the district or by the state. This meeting is essential in helping teachers to select the correct type of AT for the student as well as a device that is content specific. In doing so, teachers will have an opportunity to ask questions and understand how to use

the device. Once teachers have a firm understanding of the tool the AT specialist will be available for coaching.

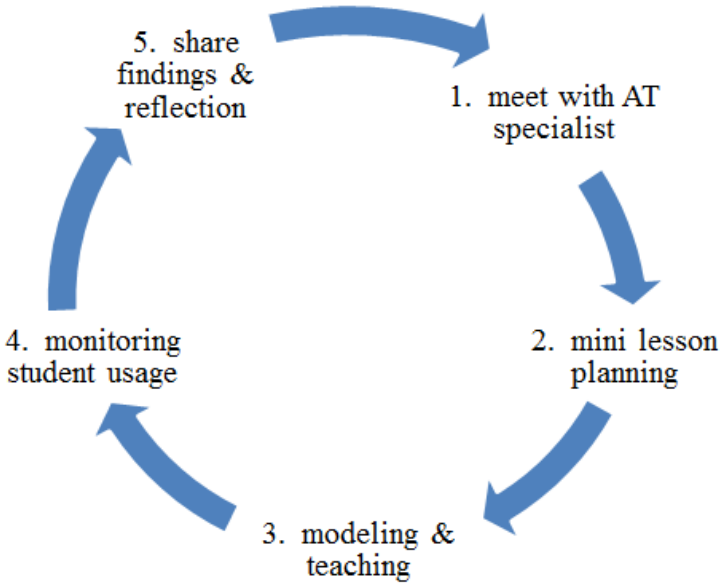


Figure 2. Implementation of action research flowchart.

In step 2, the general teacher will meet with colleagues who teach the same content, and special education teachers to create mini lessons that integrate the AT that was introduced in step 1. The mini lesson should include a teacher directed portion of how to use the AT device, a guided practice section to give the students an opportunity to practice using the device, and an independent activity that challenges the students to use the device. The teachers will generate questions that will be the focus of their action research. Additionally, the teacher will work with their colleagues to develop a systematic way of collecting data.

In steps 3 and 4, the general education teacher will carry out the lesson plan that was developed in step 2 as well as monitor the students' progress. The general education

teacher will use the data collection method that was developed in step 2 to monitor student process.

Finally, in step 5 the general education teacher will share their findings with all stakeholders such as the administrators, parents, students, and IEP team. As a result of this dialogue, the effectiveness of the AT device can be evaluated. The general education teacher will also reflect on the findings through journaling or by small group discussion with their colleagues. By reflecting on this process the teacher can make connection to part one in the professional development model.

Recommendations for Future Research

This study provides insight into secondary education teachers' perceptions of assistive technology use for students with learning disabilities. Several recommendations can be made for further research based on the results of the study. First, for generalizability purposes, this study could be replicated. The replication process should consider the following: this study was limited to a specific geographical area with a small number of participants in a rural area therefore; additional research should focus on a broader level by randomly selecting school districts in urban settings in several different states. By doing this, the study could help to determine if there are regional differences in secondary teacher's perceptions about the use of assistive technology for students who have learning disabilities.

Second, this study focuses on AT use among secondary general teachers in the content areas of English, mathematics, social studies, and science. Broadening the scope of the study to include secondary vocational and elective teachers could provide

additional valuable information about cross content planning which may benefit students with learning disabilities.

Third, with the increase of inclusive practices in general education settings, research into assistive technology use in co-taught classrooms could be explored to better understand the challenges facing general and special education teachers, and to gain an overview of the teachers' major concerns combining co-teaching models along with AT. This study found that 104 out of the 110 surveyed participants felt that AT should be used in the general education classroom. However, three of the eight special education teachers who were interviewed indicated that general education teachers are reluctant to use AT. One focus group participant noted, "I've noticed a lot of general ed teachers that kind of like, fearful, or they balk at any kind of assistive technology" which could indicate there is a need for special education teachers to introduce assistive technology as helpful resources to enhance the performance of students in their inclusion classes.

Finally, it is recommended that an in-depth study be conducted on the extent of professional development received by teachers who used AT in their classroom. A major finding in this study was that teachers felt they needed more training, to know which types of assistive technology are available, as well as how to successfully integrate the technology into their instructional practices. This is significant given that prior research has identified lack of knowledge and training as a primary cause to limited assistive technology use in the classroom (Temple, 2006).

Conclusion

Universal design for learning has been defined by D. Rose and Meyer (2006), as an option to provide a flexible learning environment that is accessible for all students. To promote a more flexible learning space these researchers argue that assistive technology can permit access to the curriculum for students who have a learning disability. However, research concerning assistive technology use in general education classrooms indicate students with disabilities are less likely to use AT as a compensatory or remedial approach during instruction (Hasselbring & Bausch, 2006). Consequently, secondary general education teachers' perception of assistive technology is important, in part, because their views could impact the academic success for students with learning disabilities. This study was conducted in order to understand secondary general education teachers' perceptions toward assistive technology use for students with learning disabilities. Using mixed-methods research, a survey, interview and a focus group questionnaire was developed to answer four research questions. General and special education teachers as well as principals from a secondary school in a Southeastern state in the US were recruited for this study. Results of the study revealed a high percentage of teachers that supported AT practices however many of them did not use the devices because due to a lack of professional development. Based on the information reported in this study, the following recommendations for continued research were provided (a) replicating the study with a larger geographical area, (b) doing a similar study differentiating responses from secondary teachers working in vocational and elective classes and those teachers working in content specific classes, (c) conducting

research to evaluate perceptions among special and general education teachers in a co-taught setting, (d) conducting research on the extent of AT training among secondary teachers who used AT in their classrooms for students with learning disabilities.

REFERENCES

Alper, S., & Raharinirina, S. (2006). Assistive technology for individuals with disabilities: A review and synthesis of the literature. *Journal of Special Education Technology*, *21*(2), 47–64.

American Psychiatric Association. (2000). *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-IV-TR*). Washington, DC: Author.

Anderson, C. L., Anderson, K. M., & Cherup, S. (2009). Investment vs. return: Outcomes of special education technology research in literacy for students with mild disabilities. *Contemporary Issues in Technology and Teacher Education* [Online serial], *9*(3), 337–355.

Ault, M. J., Bausch, M. E., & McLaren, E. M. (2013). Assistive technology service delivery in rural school districts. *Rural Special Education Quarterly*, *32*(2), 15–22.

Balanskat, A., Blamire, R., & Kefla, S. (2006). *A review of studies of ICT impact on schools in Europe*. European Schoolnet.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood, NJ: Prentice-Hall.

Barfurth, M. A., & Michaud, P. (2008). Digital video technologies and classroom practices. *International Journal of Instructional Media, 35*(3), 301–315.

Basham, J. D., & Marino, M. T. (2013). Understanding STEM education and supporting students through universal design for learning. *Teaching Exceptional Children, 45*(4), 8–15.

Bauer, J., & Kenton, J. (2005). Toward technology integration in the schools: Why it isn't happening. *Journal of Technology and Teacher Education, 13*(4), 519–546.

Bausch, M., & Ault, M. (2008). Assistive Technology Implementation Plan. *Teaching Exceptional Children*, *41*(1), 6–14.

Bausch, M., & Hasselbring, T. (2004). Assistive technology: Are the necessary skills and knowledge being developed at the preservice and in-service levels? *Teacher Education and Special Education, 27,* 97–104.

Beck, J. (2002). Emerging literacy through assistive technology. *Teaching Exceptional Children, 35*(2), 44–48.

Beggs, T. A. (2000). *Influences and barriers to the adoption of instructional technology.* Paper presented at the Proceedings on the Mid-South Instructional Technology Conference, Murfreeboro, TN.

Bernacchio, C., & Mullen, M. (2007). Universal design for learning. *Psychiatric Rehabilitation Journal*, *31*(2), 167–169.

Biancarosa, C., & Snow, C. E. (2006). *Reading next—A vision for action and research in middle and high school literacy: A report to Carnegie of New York* (2nd ed.). Washington, DC: Alliance for Excellent Education.

Biddle, S. (2006). Attitudes in education. *Science Teacher*, *73*(3), 52–56.

Bouck, E. C., Maeda, Y., & Flanagan, S. M. (2012). Assistive technology and students with high-incidence disabilities: Understanding the relationship through the NLTS2. *Remedial & Special Education, 33*(5), 298–308.

Brinkerhoff, J. (2006). Effects of a long-duration, professional development academy on technology skills, computer self-efficacy, and technology integration beliefs and practices. *Journal of Research on Technology in Education, 39*(1), 22–43.

Brown, G., & Henscheid, J. (1997, September). The toe dip or the big plunge: Providing teachers effective strategies for using technology. *TechTrends*, 17–21.

Brown-Chidsey, R. (2007). No more "waiting to fail." *Educational Leadership Association for Supervision and Curriculum Development, 10,* 40–46.

Brunner, C. (1992). *Integrating technology into the curriculum: Teaching the teachers* (Tech. Rep. No. 25). New York, NY: Bank Street College of Education.

Brunner, J. (2009). The kids can't read. *Education Digest, 75*(4), 32–36.

Bryant, B., Bryant, D., Shih, M., & Seok, S. (2010). Assistive technology and supports provision: A selective review of the literature and proposed areas of application. *Exceptionality, 18*(4), 203–213.

Bryant, D. P., & Bryant, B. R. (2003). *Assistive technology for people with disabilities*. Toronto: Pearson Education.

Bryant Davis, K. E., Dieker, L., Pearl, C., & Kirkpatrick, R. (2012). Planning in the middle: Co-planning between general and special education. *Journal of Educational & Psychological Consultation*, *22*(3), 208–226.

Buehl, M. M., & Fives, H. (2009). Exploring teachers' beliefs about teaching knowledge: Where does it come from? Does it change? *Journal of Experimental Education, 77*(4), 367–408.

Bull, G. L., & Cooper, J. M. (1997). Technology and teacher education: Past practice and recommended directions. *Action in Teacher Education, 19*(2), 97–106.

Bunch, G., & Finnegan, K. (2000). *Values teachers find in inclusive education.* Proceedings of the 5th International Special Education Conference, University of Manchester, Manchester, UK.

Bursuck, B., & Blanks, B. (2010). Evidence-based early reading practices within a Response to Intervention system. *Psychology in the Schools, 47*(5), 421–431.

Campbell, M. L. (2009). Small group computer-assisted instruction with SMART board technology. *Remedial and Special Education, 30*(1), 47–57.

Canino, F. J. (1981). Learned-helplessness theory: Implications for research in learning disabilities. *Journal of Special Education, 15*(4), 471–484.

Carey, M. A. (1995). Comment: Concerns in the analysis of focus group data. *Qualitative Health Research, 5*(4), 487–495.

Carter, N., Prater, M. A., & Dyches, T. T. (2009). *Making accommodations and adaptations for students with mild to moderate disabilities.* Upper Saddle River, NJ: Pearson Publishing.

Cennamo, K. S., Ross, J. D., & Ertmer, P. A. (2010). *Technology integration for meaningful classroom use: A standards-based approach*. Belmont, CA: Wadsworth, Cengage Learning.

Chen, C. H. (2008). Why do teachers not practice what they believe regarding technology integration? *The Journal of Educational Research,* 102(1), 65–75.

Chen, F. H., Looi, C. K., & Chen, W. W. (2009). Integrating technology in the classroom: A visual conceptualization of teachers' knowledge, goals and beliefs. *Journal of Computer Assisted Learning, 25*(5), 470–488.

Clark, M., Sang Min, L., Goodman, W., & Yacco, S. (2008). Examining male underachievement in public education: Action research at a district level. *NASSP Bulletin, 92*(2), 111–132.

Cohen, D., & Hill, H. (2000). Instructional policy and classroom performance: The mathematics reform in California. *Teachers College Record, 102*(2), 294–343.

Collins, A. (1992). Towards a design science of education. In E. Scanlon & T. O'Shea (Eds.), *New directions in educational technology.* Berlin: Springer Verlag.

Cook, A., & Hussey, S. (2002). *Assistive Technology principles and practice.* St. Louis, MO: Mosby.

Cook, B. G. (2001). A comparison of teachers' attitudes toward their included students with mild and severe disabilities. *Journal of Special Education, 34*(4), 203–213.

Cook, B. G., Semmel, M. I., & Gerber, M. M. (1999). Attitudes of principals and teachers toward inclusion: Critical differences of opinion. *Remedial and Special Education, 20,* 199–207.

Cook, B. G., Tankersley, M., Cook, L., & Landrum, T. J. (2002). Teachers' attitudes toward their included students with disabilities. *Exceptional Children, 67,* 115–135.

Copley, J., & Ziviani, J. (2004). Barriers to the use of assistive technology for children with multiple disabilities. *Occupational Therapy International*, *11*(4), 229–243.

Coppola, E. M. (2004). *Powering up: Learning to teach well with technology.* New York, NY: Teachers College Press.

Coyne, P., Ganley, P., Hall, T., Meo, G., Murray, E., & Gordon, D. (2006). Applying universal design for learning in the classroom. In D. H. Rose & A. Meyer (Eds.), *A practical reader in Universal Design for Learning* (pp. 1–13). Harvard Educational Publishing Group.

Creswell, J. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches* (3rd ed.). Thousand Oaks, CA: Sage.

Creswell, J., & Plano-Clark, V. (2007). *Designing and conducting mixed methods research.* Thousand Oaks, CA: Sage.

Creswell, J. W. (2005). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (2nd ed.). Upper Saddle River, NJ: Pearson.

Damore, S. J., & Murray, C. (2009). Urban elementary school teachers' perspectives regarding collaborative teaching practices. *Remedial & Special Education*, *30*(4), 234–244.

Davies, P. M. (2010). On school educational technology leadership. *Management in Education*, *24*(2), 55–61.

Dawes, L. (2001). What stops teachers using new technology? In M. Leask (Ed.), *Issues in teaching using ICT* (pp. 61–79). London: Routledge.

Dee, T. S., & Jacob, B. (2011). The impact of No Child Left Behind on student achievement. *Journal of Policy Analysis & Management, 30*(3), 418–446.

Demski, J. (2008). AND ACCESS for all. *T H E Journal*, *35*(12), 30–35.

Dentón, C. A., & Vaughn, S. (2008). Reading and writing intervention for older students with disabilities: Possibilities and challenges. *Learning Disabilities Research* á *Practice, 23,* 61–62.

Deshler, D. D. (2010). Written Testimony to the Senate Committee on Health, Education, Labor, and Pensions "ESEA Reauthorization: Graduating America: Adolescent Literacy." Retrieved from http://www.help.senate.gov/imo/media/doc/Deshler.pdf

Deshler, D. D., Lenz, B., Bulgren, J., Schumaker, J. B., Davis, B., Grossen, B., & Marquis, J. (2004). Adolescents with disabilities in high school setting: Student characteristics and setting dynamics. *Learning Disabilities—A Contemporary Journal*, *2*(2), 30–48.

DeSimone, J. R., & Parmar, R. S. (2006). Middle school mathematics teachers' beliefs about inclusion of students with learning disabilities. *Learning Disabilities Research and Practice, 21,* 98–110.

Duel, R. K. (1994). Development dysgraphia and motor skills disorders. *Journal of Child Learning Disabilities, 29*(10), 6–8.

Duhaney, L., & Duhaney, D. C. (2000). Assistive technology: Meeting the needs of learners with disabilities. *International Journal of Instructional Media*, *27*(4), 393.

Dunn, M. W., Elder-Hinshaw, R., Nelson, J. M., & Manset-Williamson, G. (2006). Engaging older students with reading disabilities: Multimedia inquiry projects supported by reading assistive technology. (Cover story). *Teaching Exceptional Children*, *39*(1), 6–11.

Dupoux, E., Wolman, C., & Estrada, E. (2005). Teachers' attitudes toward integration of students with disabilities in Haïti and the United States. *International Journal of Disability, Development & Education*, *52*(1), 43–58.

Dyal, A., Carpenter, L., & Wright, J. (2009). Assistive technology: What every school leader should know. *Education*, *129*(3), 556–560.

Earle, R. S. (2002). The integration of instructional technology into public education: promises and challenges. *Educational Technology, 42*(1), 5–13.

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

Edgemon, E. A., Jablonski, B. R., & Lloyd, J. W. (2006). Large-scale assessments: A teacher's guide to making decisions about accommodations. *Teaching Exceptional Children*, *38*(3), 6–11.

Edmonds, M. S., Vaughn, S., Wexler, J., Reutebuch, C., Cable, A., Tackett, K. K., & Schnakenberg, J. W. (2009). A synthesis of reading interventions and effects on reading comprehension outcomes for older struggling readers. *Review of Educational Research, 79*(1), 262–300.

Edyburn, D. L. (2000). Assistive technology and students with mild disabilities. *Focus on Exceptional Children, 32*(9), 1–24.

Edyburn, D. L. (2002). 2001 in review: A synthesis of the special education technology literature. *Journal of Special Education Technology, 17*(2), 5–24.

Edyburn, D. L. (2003a). Measuring assistive technology outcomes in writing. *Journal of Special Education Technology, 18*(2), 60–64.

Edyburn, D. L. (2003b). Rethinking assistive technology. *Special Education Technology Practice, 5*(4), 16–22.

Edyburn, D. L. (2004). Rethinking assistive technology. *Special Education Technology Practice, 5*(4), 16–23.

Edyburn, D. L. (2006). Failure is not an option: Collecting, reviewing, and acting on evidence for using technology to enhance academic performance. *Learning and Leading With Technology, 34*(1), 20–23.

Edyburn, D. L. (2009). Instructional design advances in special education technology. *Exceptionality, 17*(2), 63–65.

Edyburn, D. L. (2010). Would you recognize universal design for learning if you saw it? Ten propositions for new directions for the second decade of UDL. *Learning Disability Quarterly, 33*(1), 33–41.

Ertmer, P. A. (1999). Addressing first-and-second-order barriers to change: Strategies for technology integration. *Educational Technology Research and Development, 47*(4), 47–61.

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.

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher Technology Change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education, 42*(3), 255–284.

Ertmer, P. A., Gopalakrishnan, S., & Ross, E. M. (2001). Technology-Using teachers: Comparing perceptions of exemplary technology use to best practice. *Journal of Research on Technology in Education, 33*(5).

Evans, C., Williams, J. B., King, L., & Metcalf, D. (2010). Modeling, guided instruction, and application of UDL in a rural special education teacher preparation program. *Rural Special Education Quarterly, 29*(4), 41–48.

Foon Hew, K., & Brush, T. (2007). Integrating technology into K-12 teaching and learning: Current knowledge gaps and recommendations for future research. *Educational Technology Research Development, 55*, 223–252.

Friend, M., & Shamberger, C. (2008). Inclusion. In T. L. Good (Ed.), *Twenty-first century education* (Volume II-Students, pp. 124–130). Thousand Oaks, CA: Sage.

Frolin, C., Hattie, J., & Douglas, G. (1996). Inclusion: Is it stressful for teachers? *Journal of Intellectual & Developmental Disability, 21*, 199–217.

Garderen, D., & Whittaker, C. (2006). Planning differentiated, multicultural instruction for secondary inclusive classrooms. *TEACHING Exceptional Children, 38*, 12–20.

Gersten, R., Fuchs, L. S., Williams, J. P., & Baker, S. (2001). Teaching reading comprehension strategies to students with learning disabilities: A review of research. *Review of Educational Research, 71,* 279–320.

Glazer, E. (2004). From a caterpillar to a butterfly: The growth of a teacher in developing technology enhanced mathematical investigations. *Journal* of *Technology and Teacher Education, 12*(1), 115–138.

Gregor, P., Dickinson, A., Macaffer, A., & Andreasen, P. (2003). SeeWord: A personal word processing environment for dyslexic computer users. *British Journal of Educational Technology, 34,* 341–355.

Gulbahar, Y. (2007). Technology planning: A roadmap to successful technology integration in schools. *Computers & Education, 49*(4), 943–956.

Harris, J., Mishra, P., & Koehler, M. (2009). Teachers' technological pedagogical content knowledge and learning activity types: Curriculum-based technology integration reframed. *Journal of Research on Technology in Education, 41*(4), 393–416.

Harris, M. L., Schumaker, J. B., & Deshler, D. D. (2011). The effects of strategic morphological analysis instruction on the vocabulary performance of secondary students with and without disabilities. *Learning Disability Quarterly, 34*(1), 17–33.

Hasselbring, T. S., & Glaser, C. H. (2000). Use of computer technology to help students with special needs. *Children and Computer Technology, 10*(2), 102–122.

Hasselbring, T. S., & Bausch, M. E. (2006). Assistive technologies for reading. *Educational Leadership, 63*(4), 72–75.

Hatch, J. A. (2002). *Doing qualitative research in education settings.* New York, NY: State University of New York Press.

Heinich, R., Molenda, M., Russell, J. D., & Smaldino, S. E. (1999). *Instruction-media and technologies for learning* (6th ed.). Upper Saddle River, NJ: Merrill/Prentice Hall, Inc.

Hertzroni, O. E., & Shrieber, B. (2004). Word processing as an assistive technology tool for enhancing academic outcomes o students with writing disabilities in the general classroom. *Journal of Learning Disabilities, 37*(2), 143–154.

Higgins, E., & Raskind, M. (2000). Speaking to read: The effects of continuous vs. discrete speech recognition systems on the reading and spelling of children with learning disabilities. *Journal of Special Education Technology, 15*(1), 19–30.

Hitchcock, C., & Stahl, S. (2003). Assistive technology, universal design, universal design for learning: Improved learning opportunities. *Journal of Special Education Technology, 18*(4), 45–52.

Hitchcock, C., Meyer, A., Rose, D., & Jackson, R. (2002). Providing new access to the general curriculum. *Teaching Exceptional Children, 35*(2), 8.

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

Hughes, C., Golas, M., Cosgriff, J., Brigham, N., Edwards, C., & Cashen, K. (2011). Effects of a social skills intervention among high school students with intellectual disabilities and autism and their general education peers. *Research & Practice for Persons with Severe Disabilities, 36*(1/2), 46–61.

Hunter, B. (2001). Against the odds: Professional development and innovation under less-than-ideal conditions. *Journal of Technology and Teacher Education, 9*(4), 473–496.

Hutinger, P., Johanson, J., & Stoneburner, R. (1996). Assistive technology applications in educational programs of children with multiple disabilities: A case study report on the state of the practice. *Journal of Special Education Technology, 13*(1), 16–35.

Individuals with Disabilities Education Act of 1997, 20 U.S.C § 1400 *et seq.*

Individuals with Disabilities Education Improvement Act of 2004, 20 U.S.C. § 1400 *et seq.* (2004; reauthorization of the Individuals with Disabilities Education Act of 1990).

Irish, C. (2002). Using peg- and keyword mnemonics and computer-assisted instruction to enhance Basic multiplication performance in elementary students with learning and cognitive Disabilities. *Journal of Special Education Technology, 17*(4), 29–40.

Jitendra, A. K., & Gajria, M. (2011). Reading comprehension instruction for students with learning disabilities. *Focus on Exceptional Children, 43*(8), 1–16.

John, P. (2005). The sacred and the profane: subject sub-culture, pedagogical practice and teachers' perceptions of the classroom uses of ICT. *Educational Review, 57*(4), 471–490.

Johnson, B., & Christensen, L. (2008). *Educational research: Quantitative, qualitative, and mixed approaches* (3rd ed.). Thousand Oaks, CA: Sage.

Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research, 1*(2), 112–133.

Johnson, W. (2008). "Making Learning Easy and Enjoyable:" Anna Verona Dorris and the visual instruction movement, 1918–1928. *TechTrends, 52*(4), 51–58.

Jones, B., Valdez, G., Nowakowski, J., & Rasmussen, C. (1995). *Indicators of engaged learning. Plugging in: Choosing and using educational technology.* Oak Brook, IL: North Central Regional Educational Laboratory. Retrieved from http://www.ncrel.org/sdrs/edtalk/toc.htm

Judge, S. (2006). Constructing an assistive technology toolkit for young children: Views from the field. *Journal of Special Education Technology, 21*(4), 17–24.

Judge, S., Floyd, K., & Jeffs, T. (2008). Using an assistive technology toolkit to promote inclusion. *Early Childhood Education Journal*, *36*(2), 121–126.

Judson, E. (2006). How teachers integrate technology and their beliefs about learning: Is there a connection? *Journal of Technology and Teacher Education, 14,* 581–597.

Kara-Soteriou, J. (2009). Using technology to differentiate instruction across grade levels. *The New England Reading Association Journal, 44*(2), 86–90.

Kavale, K., & Mostert, M. (2004) Social skills interventions for individuals with learning disabilities. *Learning Disability Quarterly, 27*(1), 31–43.

Kavale, K. A., & Forness, S. R. (1996). Social skill deficits and learning disabilities: A meta-analysis. *Journal of Learning Disabilities, 29*(3), 226.

Kavale, K. A., & Forness, S. R. (1995). *The nature of learning disabilities: Critical elements of diagnosis and classification.* Mahwah, NJ: Erlbaum.

Kemp, C. E., Parette, H. P., & Hourcade, J. J. (2001). Funding assistive technology and related health services in service settings. *Early Childhood Education Journal*, *28*(3), 189.

Kennedy, M. J., & Deshler, D. D. (2010). Literacy instruction, technology, and students with learning disabilities: Research we have, research we need. *Learning Disability Quarterly*, *33*(4), 289–298.

King, T. (1999). *Assistive technology: Essential human factors.* Boston: Allyn and Bacon.

King-Sears, M. (2009). Universal design for learning: Technology and pedagogy. *Learning Disability Quarterly*, *32*(4), 199–201.

King-Sears, M., Swanson, C., & Mainzer, L. (2011). TECHnology and literacy for adolescents with disabilities. *Journal of Adolescent & Adult Literacy*, *54*(8), 569–578.

King-Sears, M. E. (2001). Three steps for gaining access to general education curriculum for learners with disabilities. *Intervention in School and Clinic, 37,* 67–76.

Kiuru, N., Haverinen, K., Salmela-Aro, K., Nurmi, J., Savolainen, H., & Holopainen, L. (2011). Students with reading and spelling disabilities: Peer groups and educational attainment in secondary education. *Journal of Learning Disabilities*, *44*(6), 556–569.

Kleiman, G. (2010). *Myths and realities about technology in K-12 schools*. Retrieved March 28, 2011, from Harvard University, Harvard Educational Review website at http://www.edletter.org/dc/kleiman.htm

Kleinhammer-Tramill, J. P., Tramill, J. L., Schrepel, S., & Davis S. (1983). Learned helplessness in learning disabled adolescents as a function of noncontingent Rewards *Learning Disability Quarterly, 6*(1), 61–66.

Koehler, M. J., & Mishra, P. (2008). Introducing TPACK. In AACTE Committee on Innovation & Technology (Eds.), *Handbook of technological pedagogical content knowledge for educators* (pp. 3–29). New York, NY: Routledge.

Kurtts, S., Dobbins, N., & Takemae, N. (2012). Using assistive technology to meet diverse learner needs. *Library Media Connection*, *30*(4), 22–23.

Kutepova, E. N. (2011). Experience of interaction between special (correctional) and general education in the context of inclusive practices. (English). *Psychological Science & Education, 1*, 103–112.

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

Lange, A. A., McPhillips, M., Mulhern, G., & Wylie, J. (2006). Assistive software tools for secondary students with literacy difficulties. *Journal of Special Education Technology, 21*(3), 13–22.

Lawless, K. A., & Pellegrino, J. W. (2007). Professional development in integrating technology into teaching and learning: Knowns, unknowns, and ways to pursue better questions and answers. *Review of Educational Research, 77*(4), 575–614.

Lee, H., & Templeton, R. (2008). Ensuring equal access to technology: providing assistive technology for students with disabilities. *Theory Into Practice, 47*(3), 212–219.

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.

Lee-Tarver, A. (2006). Are individualized education plans a good thing? A survey of teachers' perceptions of the utility of IEPs in general education settings. *Journal of Instructional Psychology, 33*(4), 263–272.

Lei, J. (2009). Digital natives as preservice teachers: What technology preparation is needed? *Journal of Computing in Teacher Education, 25*(3), 87–97.

Levin, T., & Wadmany, R. (2006). Teachers' beliefs and practices in technology-based classrooms: A developmental view. *Journal of Research on Technology in Education*, *39*(2), 157–181.

Lewis, R. B., Graves, A. W., Ashton, T. M., & Kieley, C. L. (1998). Word processing tools for students with disabilities: A comparison of strategies to increase text entry speed. *Learning Disabilities Research & Practice, 13,* 95–108.

Leyser, Y., & Tappendorf, K. (2001). Are attitudes and practices regarding mainstreaming changing? A case of teachers in two rural school districts. *Education*, *121*(4), 751–761.

MacArthur, C. (2009). Reflections on research on writing and technology for struggling writers. *Learning Disabilities Research & Practice, 24*(2), 93–103.

MacArthur, C. A. (2000). New tools for writing: Assistive technology for students with writing difficulties. *Topics in Language Disorders, 20,* 85–100.

Maccini, P., Gagnon, J. C., & Hughes, C. A. (2002). Technology-based practices for secondary students with learning disabilities, *Learning Disability Quarterly, 25*(4), 247–261.

MacLean, J. (2008). The art of inclusion. *Canadian Review of Adult Education, 35,* 75–98.

McGrail, E. (2005). Teachers, technology, and change: English teachers' perspectives. *Journal of Technology and Teacher Education, 13,* 5–24.

Malmgren, K. W., & Trezek, B. J. (2009). Literacy instruction for secondary students with disabilities. *Focus On Exceptional Children, 41*(6), 1–12.

Marino, M. T. (2009). Understanding how adolescents with reading difficulties utilize technology-based tools, *Exceptionality, 17*(2), 88–102.

Marino, M. T., Tsurusaki, B. K., & Basham, J. D. (2011). Selecting software for students with learning and other disabilities. *Science Teacher, 78*(3), 70–72.

Marino, M. T., Marino, E. C., & Shaw, S. F. (2006). Making informed assistive technology decisions for students with high incident disabilities. *Teaching Exceptional Children, 38*(6), 18–25.

Mastropieri, M. A., Scruggs, T. E., & Graetz, J. E. (2003). Reading comprehension instruction for secondary students: Challenges for struggling students and teachers. *Learning Disability Quarterly, 26,* 103–116.

Mastropieri, M. A., Scruggs, T. E., Mohler, L. J., Beranek, M. L., Spencer, V., Boon, R. T., & Talbott, E. (2001). Can middle school students with serious reading

difficulties help each other and learn anything? *Learning Disabilities: Research and Practice, 16*(1), 18–27.

Mattson, E., & Roll-Pettersson, L. (2007). Segregated groups or inclusive education? An interview study with students experiencing failure in reading and writing. *Scandinavian Journal of Educational Research, 51*(3), 239–252.

Mavrou, K. (2011). Assistive technology as an emerging policy and practice: Processes, challenges and future directions. *Technology & Disability, 23*(1), 41–52.

McKenna, M. C., & Walpole, S. (2007). Assistive technology in the reading clinic: It's emerging potential. *Reading Research Quarterly, 42*(1), 140–145.

McKenney, S., & Voogt, J. (2009). Designing technology for emergent literacy: The PictoPal initiative. *Computers & Education, 52*(4), 719–729.

Melekoglu, M. A. (2011). Impact of motivation to read on reading gains for struggling readers with and without learning disabilities. *Learning Disability Quarterly, 34*(4), 248–261.

Meo, G. (2008). Curriculum planning for all learners: Applying Universal Design for Learning (UDL) to a high school reading comprehension program. *Preventing School Failure, 52*(2), 21–28.

Messinger-Willman, J., & Marino, M. T. (2010). Universal design for learning and assistive technology: Leadership considerations for promoting inclusive education in today's secondary schools. *NASSP Bulletin, 94*(1), 5–16.

Meyer, A., & Rose, D. H. (1998). *Learning to read in the computer age*. Cambridge, MA: Brookline Books.

Meyer, A., & Rose, D. H. (2002). *Teaching every student in the digital age: Universal design for learning.* Alexandria, VA: Association for Supervision and Curriculum Development.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis* (2nd ed.). Thousand Oaks, CA: Sage.

Miller, M. J., Lane, K., & Wehby, J. (2005). Social skills instruction for students with high-incidence disabilities: A school-based intervention to address acquisition deficits. *Preventing School Failure, 49*(2), 27–39.

Milsom, A., & Glanville, J. L. (2010). Factors mediating the relationship between social skills and academic grades in a sample of students diagnosed with learning disabilities or emotional disturbance. *Remedial & Special Education*, *31*(4), 241–251.

Mistrett, S. G., Lane, S. J., & Ruffino, A. G. (2005). Growing and learning through technology: Birth to five. In D. Edyburn, K. Higgins, & R. Boone (Eds.), *Handbook of special education technology research and practice* (pp. 273–308). Whitefish Bay, WI: Knowledge by Design.

Moats, L. C. (2001). When older students can't read. *Educational Leadership, 58*(6), 36–40.

Molto, B. H. (2003). Mainstream teachers' acceptance of instructional adaptations in Spain. *European Journal of Special Needs Education, 18*(3), 311–332.

Morse, J. M. (1991). Approaches to qualitative-quantitative methodological triangulation. *Nursing Research, 40,* 120–123.

Mueller, J., Wood, E., Willoughby, T., Ross, C., & Specht, J. (2008). Identifying discriminating variables between teachers who fully integrate computers and teachers with limited integration, *Computers & Education, 51*(4), 1523–1537.

National Assistive Technology Research Institute. (2005). [Assistive technology state case studies]. Unpublished raw data.

National Center for Learning Disabilities. (2013). High school graduation. Retrieved from http://www.ncld.org/images/content/files/hill-briefs/hs-grad-brief-template.pdf

National Joint Committee on Learning Disabilities. (2008). Adolescent literacy and older students with learning disabilities. *Learning Disability Quarterly, 31*(4), 211–218.

National Reading Panel. (2001). *Teaching children to read.* Retrieved December 28, 2011, from http://www.nichd.nih.gov/publications/nrp/upload/smallbook_pdf.pdf

No Child Left Behind Act. (2001). *Elementary and secondary education.* Retrieved from http://www.ed.gov/policy/elsee/leg/eseaO2/index.html

Okolo, C. M., & Bouck, E. C. (2007). Research about assistive technology: 2000–2006. What have we learned? *Journal of Special Education Technology, 22*(3), 19–33.

Palak, D., & Walls, R. (2009). Teachers' beliefs and technology practices: A mixed-methods approach. *Journal of Research on Technology in Education, 41*(4), 417–441.

Parette, H. P., Blum, C., & Boeckmann, N. (2009). Evaluating assistive technology in early childhood education: The use of a concurrent time series probe approach. *Early Childhood Education Journal, 37*(1), 5–12.

Parette, H. P., Hourcade, J., Blum, C., Watts, E., Stoner, J., Wojcik, B., & Chrismore, S. (2013). Technology user groups and early childhood education: A preliminary study. *Early Childhood Education Journal*, *41*(3), 171–179.

Parette, H. P., Peterson-Karlan, G. R., Wojcik, B. W., & Bardi, N. (2007). Monitor that progress! *Teaching Exceptional Children*, *40*(1), 22–29.

Parette, H. P., & Stoner, J. B. (2008). Benefits of assistive technology use groups for early childhood education professionals. *Early Childhood Education Journal, 35*(4), 313–319.

Parette, P., & McMahan, G. A. (2002). What should we expect of assistive technology? *Teaching Exceptional Children*, *35*(1), 56.

Passey, D., Rogers, C., Machell, J., McHugh, G. & Allaway, D. (2004). *Emergent findings: The motivational effect of ICT on pupils.* London: DfES.

Pearman, C. (2008). Independent reading of CD-ROM storybooks: Measuring comprehension with oral retellings. *Reading Teacher, 61*(8), 594–602.

Pelgrum, W. J. (2001). Obstacles to the integration of ICT in education: Results from a worldwide educational assessment. *Computers & Education, 37*, 163–178.

Performance-avoidance may relate to depression in youths with LD. (2008). *Brown University Child & Adolescent Behavior Letter*, *24*(1), 2.

Pierce, R., & Ball, L. (2009). Perceptions that may affect teachers' intention to use technology in secondary mathematics classes. *Educational Studies in Mathematics*, *71*(3), 299–317.

Pisha, B., & Coyne, P. (2001). Smart from the start. *Remedial & Special Education, 22*(4), 197.

Pitler, H. (2006). Viewing technology through three lenses. *Principal (Reston, Va.), 85*(5), 38–42.

Pliner, S. M., & Johnson, J. R. (2004). Historical, theoretical, and foundational principles of universal instructional; design in higher education. *Equity & Excellence in Education, 37*(1), 105–113.

Puckett, K. S. (2004). Project ACCESS: Field testing an assistive technology toolkit for students with mild disabilities. *Journal of Special Education Technology, 19*(2), 5–17.

Quenneville, J. (2001). Tech tools for students with learning disabilities: Infusion into inclusive classrooms. *Preventing School Failure, 45*(4), 167.

Quinn, B. S., Behrmann, M., Mastriopieri, M., & Chung, Y. (2009). Who is using assistive technology in schools? *Journal of Special Education Technology, 24*(1), 1–13.

Rapp, W. H. (2005). Using assistive technology with students with exceptional learning needs: When does an aid become a crutch? *Reading & Writing Quarterly, 21*(2), 193–196.

Rohaan, E. J., Taconis, R., & Jochems, W. G. (2009). Measuring teachers' pedagogical content knowledge in primary technology education. *Research in Science & Technological Education, 27*(3), 327–338.

Rose, D., & Meyer, A. (2000a). Universal design for individual differences. *Educational Leadership, 58*(3), 39–43.

Rose, D., & Meyer, A. (2000b). Universal design for learning. *Journal of Special Education Technology, 15*(1), 67–70.

Rose, D., & Meyer, A. (2006). *A practical reader in universal design for learning.* Cambridge, MA: Harvard University Press.

Rose, D., Meyer, A., & Hitchcock, C. (2005). *The universally designed classroom: Accessible curriculum and digital technologies.* Cambridge, MA: Harvard Education Press.

Rose, D. H., Hasselbring, T. S., Stahl, S., & Zabala, J. (2005). *Assistive technology and universal design for learning: Two sides of the same coin.* In D. Edyburn, K. Higgins, & R. Boone (Eds.), *Handbook of special education technology, research, and practice* (pp. 507–518). Whitefish Bay, WI: Knowledge by Design.

Scheeler, M., Congdon, M., & Stansbery, S. (2010). Providing immediate feedback to co-teachers through bug-in-ear technology: An effective method of peer coaching in inclusion classrooms. *Teacher Education and Special Education, 33*(1), 83–96.

Schensul, S. L., Schensul, J. J., & LeCompte, M. D. (1999). Semistructured interviewing. In S. L. Schensul, J. J. Schensul, & M. D. LeCompte (Eds.), *Essential 170 ethnographic methods: Observations, interview, and questionnaires* (pp. 149–164). Walnut Creek, CA: Altamira Press.

Scherer, M. J. (2004). *Connecting to learn: Educational and assistive technology for people with disabilities.* Washington, DC: American Psychological Association.

Schoepp, K. (2005). Barriers to technology integration in a technology-rich environment. *Learning and teaching in Higher Education: Gulf Perspectives, 2*(1), 1–24.

Schulte, A. C., Osborne, S. S., & Erchul, W. P. (1998). Effective special education: A United States dilemma. *School Psychology Review, 27,* 66–76.

Scott, B. J., Vitale, M. R., & Masten, W. G. (1998). Implementing instructional adaptations for students with disabilities in inclusive classrooms. *Remedial & Special Education, 19*(2), 106.

Shah, N. (2012). States adapting best practices from special ed. for standards. *Education Week, 31*(29), S32–S33.

Sharpe, M. E. (2010). *Assistive technology attrition: Identifying why teachers abandon assistive technologies.* (Nova Southeastern University). *ProQuest Dissertations and Theses,* 121. Retrieved from http://search.proquest.com/docview/746840586?accountid=14604

Shaw, R. A. (2011). Employing universal design for instruction. *New Directions for Student Services, 134,* 21–33.

Sicilia, C. (2005). *The challenges and benefits to teachers' practices in constructivist learning environments supported by technology*. Unpublished master's thesis, McGill University, Montreal.

Sideridis, G. D. (2003). On the origins of helpless behavior of students with learning disabilities: Avoidance motivation? *International Journal of Educational Research, 39*(4/5), 497–517.

Sideridis, G. D. (2007). Why are students with LD depressed? *Journal of Learning Disabilities, 40*(6), 526–539.

Sideridis, G. D., Mouzaki, A., Simos, P., & Protopapas, A. (2006). Classification of students with reading comprehension difficulties: The roles of motivation, affect, and psychopathology. *Learning Disability Quarterly, 29,* 159–180.

Siegel, L. S. (1999). Issues in definition and diagnosis of learning disabilities: A perspective on Guckenberger vs. Boston University. *Journal of Learning Disabilities, 32,* 304–319.

Silver-Pacuilla, H. (2006). *Moving toward solutions: Assistive & learning technology for all students.* Washington, DC: National Center for Technology Innovation. Retrieved December, 28, 2011, from http://www.nationaltechcenter.org/

Simpson, C., McBride, R., Spencer, V., Lowdermilk, J., & Lynch, S. (2009). Assistive technology: Supporting learners in inclusive classrooms. *Kappa Delta Pi Record, 45*(4), 172–175.

Smith, P., & O'Brien, J. (2007). Have we made any progress? Including students with intellectual disabilities in regular education classrooms. *Intellectual and Developmental Disabilities, 45*(5), 297–309.

Snoeyink, R., & Ertmer, P. (2001/2002). Thrust into technology: How veteran teachers respond. *Journal of Educational Technology Systems, 30,* 85–111.

Snyder, T. D. (2008). *Mini-digest of education statistics, 2007* (NCES 2008-023). Washington, DC: National Center for Education Statistics, Institute of Educational Sciences, U.S. Department of Education.

Stanford, P., & Reeves, S. (2007). Access, consider, teach: ACT in your classroom. *Clearing House: A Journal of Educational Strategies, Issues and Ideas, 80*(3), 133–136.

Technology-Related Assistance for Individuals with Disabilities Act. 29 US.C. § 2201 *et seq.* (1988).

Temple, C. 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).

Tillema, H. H. (1995). Changing the professional knowledge and beliefs of teachers: A training study. *Learning and Instruction, 5,* 291–318.

Todis, B. J. (1996). Tools for the task? Perspectives on assistive technology in education settings. *Journal of Special Education Technology, 13,* 49–61.

Torgerson, C. W., Miner, C. A., & Hong, S. (2004). Developing student competence in self-directed IEPs. *Intervention in School & Clinic, 39*(3), 162–167.

Traynor, P. L. (2003). Effects of computer-assisted-instruction on different learners. *Journal of Instructional Psychology, 30*(2), 137.

Valas, H. (2001). Learned helplessness and psychological adjustment II: Effects of learning disabilities and low achievement. *Scandinavian Journal of Educational Research, 45,* 101–114.

Van Daal, V., & Reitsma, P. (2000). Computer-assisted learning to read and spell: results from two pilot studies. *Journal of Research in Reading, 23*(2), 181–193.

Vaughn, S., Wanzek, J., Wexler, J., Barth, A., Cirino, P. T., Fletcher, J. M., & Francis, D. J. (2010). The relative effects of group size on reading progress of older students with reading difficulties. *Reading and Writing: An Interdisciplinary Journal, 23,* 931–956.

Voltz, D., & Collins, L. (2010). Preparing special education administrators for inclusion in diverse, standards-based contexts: Beyond the council for exceptional children and the interstate school leaders licensure consortium. *Teacher Education and Special Education*, *33*(1), 70–82.

Vygotsky, L. S. (1978). *Mind and society: the development of higher mental process.* Cambridge, MA: Harvard University Press.

Wallace, J. (2011). Assistive technology funding in the United States. *Neurorehabilitation, 28*(3), 295–302.

Wanzek, J., Vaughn, S., & Wexler, J. (2006). A synthesis of spelling and reading interventions and their effects on the spelling outcomes of students with LD. *Journal of Learning Disabilities*, *39*(6), 528–543.

Wasta, M. J. (2006). No Child Left Behind: The death of special education? *Phi Delta Kappan, 88*(4), 298–299.

Wehmeyer, M. L. (1998). National survey of the use of assistive technology by adults with mental retardation. *Mental Retardation, 36*(1), 44.

Wehmeyer, M. L. (2006). Universal design for learning, access to the general education curriculum and students with mild mental retardation. *Exceptionality, 14*(4), 225–235.

Wei, X., Blackorby, J., & Schiller, E. (2011). Growth in reading achievement of students with disabilities, ages 7 to 17. *Exceptional Children, 78*(1), 89–106.

White, E. A., Wepner, S. B., & Wetzel, D. C. (2003). Accessible education through assistive technology. *T.H.E. Journal, 30*(7), 24–32.

Williamson-Henriques, K., & Friend, M. (2012). Assistive technology in special education. In J. A. Banks (Ed.), *Encyclopedia of Diversity in Education*. Thousand Oaks, CA: Sage.

Womack, S. A., Marchant, M., & Borders, D. (2011). Literature-based social skills instruction: A strategy for students with learning disabilities. *Intervention in School & Clinic, 46*(3), 157–164.

Woodward, J., & Rieth, H. (1997). A historical review of technology research in special education. *Review of Education Research, 67*, 503–536.

Wright, W. D., & Wright, P. D. (2009). *Special Education Law*. Hartfield, VA: Harbor House Law Press.

Ysseldyke, J. (2001). Reflections on a research career: Generalization from 25 years of research on assessment and instructional decision making. *Exceptional Children, 67*(3), 295.

Yuen, A. K., & Ma, W. K. (2008). Exploring teacher acceptance of e-learning technology. *Asia-Pacific Journal of Teacher Education, 36*(3), 229–243.

Zascavage, V., & Winterman, K. G. (2009). What middle school educators should know about assistive technology and universal design for learning? *Middle School Journal, 40*(4), 46–52.

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., & Frank, K. A. (2003). Factors affecting technology uses in schools: An ecological perspective. *American Educational Research Journal, 40*(4), 807–840.

APPENDIX A

SECONDARY TEACHERS' PERCEPTIONS OF ASSISTIVE TECHNOLOGY USE WITH STUDENTS WITH LEARNING DISABILITIES SURVEY

The purpose of this project is to determine the perceptions of general education teachers toward assistive technology use for students with learning disabilities. Please read the following definitions related to the study before taking the survey.

Definition of Terms

Assistive Technology as defined by The Individual with Disabilities Education Improvement Act (IDEIA) re-authorized in 2004 states:

> The term 'assistive technology device means 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 functional capabilities of a child with a disability.

Learning Disability:

> The term *specific learning disability* refers to a student having an educational disability in the area of reading, writing, or math. A learning disability **does not** include a learning problem that is primarily the result of visual, hearing, or motor disabilities, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage.

Please answer the following questions about assistive technology based upon this IDEIA definition. **Please note that *assistive technology* is a broad term. Assistive technology includes items that may not typically be considered "technology" (i.e., pencil grips and graphic organizers), and also includes high-tech items (i.e., reading pen and speech to text).**

Survey of Secondary Teachers' Perceptions of Assistive Technology Use with Students with Learning Disabilities

Demographic Questions

Please indicate your response by selecting the choice which best matches your answer

1. Gender
   - O Male
   - O Female

2. Number of years teaching
   - O Less than 5 years
   - O 5 to 9 years
   - O 10 to 20 years
   - O More than 20 years

3. Highest level of Education
   - O Bachelor's
   - O Master's
   - O Doctorate

4. Current area of Certification
   - O Math
   - O English
   - O Science
   - O Social Studies
   - O Other _____

5. Number or years teaching classes that include students with Learning Disabilities (inclusion)
   - O I have never taught an inclusion class with students who have a learning disability
   - O Fewer than 5 years
   - O 5 to 9 years
   - O 10 to 20 years
   - O More than 20 years

6. During the current school year, how many inclusion classes do you teach?

- None
- 1
- 2
- 3
- 4
- 5 or more

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

- none
- Fewer than 5 years
- 5 to 9 years
- 10 to 20 years
- More than 20 years

Part One: Usage of Assistive Technology

Instructions: For each item in this section, please select the response that best indicates your level of agreement or disagreement with each statement.

8. Special education teachers offer me assistance in implementing appropriate assistive technology for students with LD in my class

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

9. I only use assistive technology devices after recommendations from the IEP team.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

10. I provide input on the selection of assistive technology devices during IEP team meetings

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

11. I differentiate a lesson by incorporating assistive technology.
    - O Strongly Agree
    - O Agree
    - O Disagree
    - O Strongly Disagree

12. I maintain the assistive technology devices that my student(s) and I use.
    - O Strongly Agree
    - O Agree
    - O Disagree
    - O Strongly Disagree

13. Listed below are some of the most commonly used types of Assistive Technology for students with LD. Please mark the types of AT you have used with your students with LD:

Reading
- O Audiotaped/CD books
- O Electronic books (Nook, iPad, Daisy Reader, Kindle, etc.)
- O Reading Pen
- O Changes in background color
- O screen magnification software
- O large print material
- O Changes in spacing of words
- O Screen readers- (This program scans the text and converts the written text into spoken language via speech synthesis)

Writing
- O Word processor
- O Spell checker
- O Proofreading programs
- O Outlining/"brainstorming" programs
- O Voice recognition software
- O Screen reading programs
- O Word prediction programs
- O Slant board
- O Keyguard
- O Alternative keyboard
- O Pencil grip
- O Adapter paper(bold line, raised line, different paper)

- Tape recorder for note taking
- Electronic spell checker without auditory output
- Electronic spell checker with auditory output

Mathematics

- Talking calculator
- Conventional calculator
- On-screen (computer-based) calculator
- Graph paper
- Calculation chart
- Software with template for math computation

Listening

- Conventional tape recorder/player
- FM amplification device
- Laptop for note taking

Organization/Memory

- Personal data managers (standalone)
- Personal data organization software
- Free-form database
- Calendar programs
- Tape recorder/player
- Index cards
- Highlight text with markers or tape
- Color- coded folders or index tabs
- Graphic organizer worksheets
- Electronic organizer (Palm Pilot)
- Software for organization of ideas (Kidspiration/ Inspiration)

Part Two: Teacher attitudes and beliefs about Assistive Technology

Instructions: For each item in this section, please select the response that best indicates your level of agreement or disagreement with each statement.

14. When deciding on assistive technology for a specific student, the IEP team considers the student's needs more than the ready availability of a specific device.

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

15. The availability of AT devices for students with LD is important in my class.
    - o Strongly Agree
    - o Agree
    - o Disagree
    - o Strongly Disagree

16. Assistive technology devices are useful for all core academic classes.
    - o Strongly Agree
    - o Agree
    - o Disagree
    - o Strongly Disagree

17. Assistive technology enables students with LD to access the curriculum more readily.
    - o Strongly Agree
    - o Agree
    - o Disagree
    - o Strongly Disagree

18. AT devices help student with LD learn more readily in my class.
    - o Strongly Agree
    - o Agree
    - o Disagree
    - o Strongly Disagree

19. General education teachers should use AT in the regular education classroom.
    - o Strongly Agree
    - o Agree
    - o Disagree
    - o Strongly Disagree

20. Only special education teachers should implement assistive technology for students with LD in resource classes
    - o Strongly Agree
    - o Agree
    - o Disagree
    - o Strongly Disagree

21. Using assistive technology slows the pace of learning for the entire class.
    - o Strongly Agree
    - o Agree
    - o Disagree
    - o Strongly Disagree

22. AT can cause disruptions in the classroom.
    - o Strongly Agree
    - o Agree
    - o Disagree
    - o Strongly Disagree

23. The use of assistive technology makes students reliant on the tool and negatively affects their skill development.
    - o Strongly Agree
    - o Agree
    - o Disagree
    - o Strongly Disagree

24. Overall, assistive technology devices help students with LD complete their assignments in my class.
    - o Strongly Agree
    - o Agree
    - o Disagree
    - o Strongly Disagree

25. I have seen students make academic progress because of their use of assistive technology.
    - o Strongly Agree
    - o Agree
    - o Disagree
    - o Strongly Disagree

Part Three: Supports and barriers to Assistive Technology
Instructions: For each item in this section, please select the response that best indicates your level of agreement or disagreement with each statement.

26. My school provides adequate training in and knowledge of assistive technology for my classroom needs.
    - O Strongly Agree
    - O Agree
    - O Disagree
    - O Strongly Disagree

If you answered *strongly agree or agree* on question 26 please mark all training that apply

- o in a college course(s)
- o inservice training(s) on the general use of assistive technology
- o inservice training(s) on the use of a particular assistive technology product/device
- o instructional material(s) that came with a particular assistive technology product/device
- o webinar(s) or other web-based support
- o no initial training on a particular assistive technology product/device, but technical support or coaching after I was already using this product/device
- o technical support from my school or an agency
- o informally from a colleague
- o Other_____
  _____
  _____

27. I would use assistive technology more frequently if there were more support from a specialist to help me with problems that arise.
    - O Strongly Agree
    - O Agree
    - O Disagree
    - O Strongly Disagree

28. I am reluctant to use assistive technology because it frequently does not work correctly.
    - O Strongly Agree
    - O Agree
    - O Disagree
    - O Strongly Disagree

29. 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.
    - o Strongly Agree
    - o Agree
    - o Disagree
    - o Strongly Disagree

30. Assistive technology requires too much time to use during class.
    - o Strongly Agree
    - o Agree
    - o Disagree
    - o Strongly Disagree

31. I think administrators, special teachers, and parents are helpful when I need help or an explanation of the AT device used for students in my class.
    - o Strongly Agree
    - o Agree
    - o Disagree
    - o Strongly Disagree

32. I need more opportunities to collaborate with colleagues in my discipline on how to use assistive technology.
    - o Strongly Agree
    - o Agree
    - o Disagree
    - o Strongly Disagree

Part Four: Additional Comments

33. What other comments do you have regarding assistive technology in relation to students with LD in your classroom?

Your time and willingness to assist in this research is greatly appreciated.

APPENDIX B

FOCUS GROUP PROCEDURE/QUESTIONS

Focus Group Interviews: Procedures and Questions

1. Basic introductions: Facilitator and participants. Thank-you for making time in your busy schedule to participate in this study.

2. Purpose: The goal of today's focus group is to hear your perspectives on assistive technology. I'll be asking you some specific questions just to help guide our conversation, but the intent is for me to hear about your experiences, understandings, and perspectives.

3. Before we begin, there are a few mechanics to address. First, I'm recording the session to capture all the ideas everyone will share. The recording will go back to UNCG with me; no one in your county will ever access the recording, and once all the information is reviewed, the original recording will be destroyed. The only identifying information that will be associated with your responses will be your position (e.g., general education secondary teacher). No personal information will be kept.

Questions

1. Let's start with your own understanding of assistive technology, how do you define assistive technology?

2. If I visited your school, what would I see in terms of assistive technology? What might I not see that you would like to have there?

3. How would you describe the overall way students with LD receive their education in a general education setting as it relates to assistive technology?

4. How much of a need do you see for assistive technology use to increase or decrease general education classrooms? On what basis are you making your decision?

5. To what extent do you perceive administrative support for assistive technology use in classrooms? What type of training would help administrators be better able to foster assistive technology use in general education settings?

6. If you were in charge on the topic of assistive technology, what would you do to increase assistive technology use in schools?

7. In your experiences, what student achievement have you seen using assistive technology?

8. What is the best example of assistive technology you have seen/heard about? The worst?

9. As a general education teacher how prepared are you to at making accommodations using AT for students with LD? If you were recommending training, what would it include?

10. How prepared are EC teachers at recommending assistive technology devices or services? If you were recommending training for them, what would it include?

11. What are some barriers to assistive technology implementation in your classroom?

12. What else needs to be shared with your school district decision-makers regarding assistive technology?

Closing

Thank you again for making time to participate in this group. Your responses are critically important in this study.

APPENDIX C

SEMI-STRUCTURED INTERVIEW PROCEDURE/QUESTIONS

Semi- Structured Interview: Procedures and Questions

Interview with Principals

Id Number: _____

Introduction

Thank you for agreeing to allow me to interview you. I am interested in learning about assistive technology practices from an administrator's perspective. I have a few questions, but if anything I ask is uncomfortable or unclear please let me know.

1. When you visit a classroom, what are the first things you look for as signs that the classroom is an effective learning place for students with learning disabilities?

2. How available is technology in your school for student instruction?

3. How do you identify the technology needs of students with learning disabilities as it relates to instruction?

4. What does the term "assistive technology" mean to you?

5. What assistive devices and technologies have you worked with or are familiar with in the classroom setting (for example, software programs)?

6. Please share what professional development activities you have provided for general education teachers and what specific steps you would take to promote and encourage continued professional development in the area of assistive technology.

7. How dedicated are general education teachers to the idea of integration and use of technology in the classroom?

8. Give me an example of one of the most frequently types technology in the general education classroom.

9. If you became aware of a teacher that is having difficulty integrating assistive technology into their content, what would you do to help?

10. What has been your biggest challenge(s) as it relate to technology integration within inclusion classes?

11. How is Assistive Technology integrated in terms of funding and curriculum in your school?

12. What are your future goals with regard to assistive technology in the general education setting?

Thank you again for making time to participate in this interview. Your responses are critically important in this study.

Demographic Survey for Principals

1. Gender
    - Male
    - Female

2. Number of years as a Principal
    - Less than 5 years
    - 5 to 9 years
    - 10 to 20 years
    - More than 20 years

3. Number of years teaching
    - Less than 5 years
    - 5 to 9 years
    - 10 to 20 years
    - More than 20 years

4. Highest level of Education
    - Bachelor's
    - Master's
    - Doctorate

5. Area of Certification (other than administration)
    - Math
    - English
    - Science
    - Social Studies
    - Other _____

6. How many years of experience do you have using assistive technology?
    - none
    - Fewer than 5 years
    - 5 to 9 years
    - 10 to 20 years
    - More than 20 years

Interview with Special Education Teachers

Id Number: _____

Introduction

Thank you for agreeing to allow me to interview you. I am interested in learning about assistive technology practices from a special education teacher's perspective. I have a few questions, but if anything I ask is uncomfortable or unclear please let me know.

1. When you visit a classroom, what are the first things you look for as signs that the classroom is an effective learning place for students with learning disabilities?

2. How available is technology in your school for student instruction?

3. How is technology used in your school for student instruction?

4. How do you identify the technology needs of students with learning disabilities as it relates to instruction?

5. What does the term "assistive technology" mean to you?

6. What assistive devices and technologies have you worked with or are familiar with in the classroom setting (for example, software programs)?

7. Please share what professional development activities/or ideas you have provided for general education teachers and what specific steps you would take to promote and encourage continued professional development in the area of assistive technology

8. How dedicated are general education teachers to the idea of integration and use of technology in the classroom?

9. Give me an example of one of the most frequently types technology in the general education classroom.

10. If you became aware of a general education teacher that is having difficulty integrating assistive technology into their content, what would you do to help?

11. What has been your biggest challenge(s) as it relate to technology integration within inclusion classes?

12. What are your future goals with regard to assistive technology in the general education setting?

Thank you again for making time to participate in this interview. Your responses are critically important in this study.

Demographic Survey for
Special Education Teachers

1. Gender
    - Male
    - Female

2. Number of years teaching
    - Less than 5 years
    - 5 to 9 years
    - 10 to 20 years
    - More than 20 years

3. Highest level of Education
    - Bachelor's
    - Master's
    - Doctorate

4. Area of Certification
    - Math
    - English
    - Science
    - Social Studies
    - Only special education
    - Other _____

5. How many years of experience do you have using assistive technology?
    - none
    - Fewer than 5 years
    - 5 to 9 years
    - 10 to 20 years
    - More than 20 years

APPENDIX D

IRB APPROVAL NOTICE

THE UNIVERSITY of NORTH CAROLINA
GREENSBORO

OFFICE OF RESEARCH COMPLIANCE
2718 Beverly Cooper Moore and Irene Mitchell Moore
Humanities and Research Administration Bldg.
PO Box 26170
Greensboro, NC 27402-6170
336.256.1482
Web site: www.uncg.edu/orc
Federalwide Assurance (FWA) #216

To: William Bursuck
Specialized Education Services
436 School of Education Building

From: UNCG IRB

Authorized signature on behalf of IRB

Approval Date: 10/22/2012
Expiration Date of Approval: 9/30/2013

RE: Notice of IRB Approval by Expedited Review (under 45 CFR 46.110)
Submission Type: Modification
Expedited Category: Minor Change to Previously Reviewed Research
Study #: 12-0328
Study Title: Secondary Teachers' Perceptions of Assistive Technology Use for Students With Learning Disabilities

This submission has been approved by the above IRB for the period indicated. It has been determined that the risk involved in this modification is no more than minimal.

Submission Description:

This modification, dated 10/16/12, addresses the following:

- Addition of letters of support from school principals.
- The following schools are approved: East Hoke Middle School, West Hoke Middle School, Turlington Alternative School, Hoke County High School

Investigator's Responsibilities

Signed letters, along with stamped copies of consent forms and other recruitment materials will be scanned to you in a separate email. These consent forms must be used unless the IRB has given you approval to waive this requirement.

CC:
Stephanie Kurtts, Specialized Education Services
Kendra Williamson
ORC, (ORC), Non-IRB Review Contact