TEACHER KNOWLEDGE OF ASSISTIVE TECHNOLOGY
FOR INCLUSIVE CLASSROOMS

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ABSTRACT

This nonexperimental, mixed-methods study explored elementary general and special education teachers’ knowledge related to assistive technology as both teacher groups are charged with the appropriate education of students with special needs in inclusive classrooms. The study sought to examine the nature of the knowledge that drives the decision making process related to assistive technology and how such knowledge is acquired. The conceptual framework for this study was a blend of Shulman’s concept of pedagogical content knowledge as a category within the teacher knowledge base and Shulman’s sources of teacher knowledge.

Participants for the study included elementary general and special education teachers from a school district in Northeast Alabama. Teachers completed a survey during which they rated their level of familiarity with each device, their perceived utility of each device, and, if applicable, a brief description of how they have implemented the device and how they acquired knowledge related to the device. Then, the researcher conducted three focus groups: a focus group of elementary general education teachers, a focus group of elementary special education teachers, and a focus group that blended the two teacher groups. Data from the focus groups were analyzed through the lens of Shulman’s concept of pedagogical content knowledge and sources of teacher knowledge.

Results from the study suggested a significant difference in the knowledge of assistive technology between elementary general education teachers and elementary special education teachers. Yet, both teacher groups involved within the study seemed to view assistive technology as a valuable tool for benefitting students with special needs in inclusive classrooms. Knowledge of how to select and implement assistive technology appears to be a very specialized
knowledge that teachers perceive as valuable when attempted to education a variety of students with special needs who may not be able to access the content and curriculum in the same ways as their peers. Thus, pre-service teacher preparation programs may ensure that both general and special education teacher candidates are prepared to work with a variety of diverse learners in inclusive settings by including assistive technology within the curricula for teacher education programs. Furthermore, school districts may assist their teachers in the successful educating of all students in inclusive classrooms by ensuring that both general and special education teachers are provided with adequate professional development related to effective inclusive practices, including assistive technology.
DEDICATION

“As is the mother, so is her daughter.” Ezekiel 16:44

I would like to dedicate this dissertation to my mother. From my earliest memories, she was always there, constantly encouraging me to never settle for anything less than my best. Her support throughout the process of attaining my PhD has been invaluable and unwavering. It is my sincerest hope that one day I am half the woman, mother, and scholar that she is.
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CHAPTER I:  
INTRODUCTION  

Introduction  

Assistive technology (AT) is defined by the Individuals with Disabilities Education Improvement Act ([IDEIA], 2004) 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” (§ 1401 (1) (A)). The IDEIA includes a requirement for both AT devices and services. Services include selecting, acquiring, and assisting students with the use of AT devices. AT must be considered by the Individualized Education Plan (IEP) team when creating IEPs. The IDEIA also calls for general education teachers to be involved in the IEP process.

Statement of the Problem  

In 2006, there were over six million students identified as having disabilities in public schools in the United States. Fifty-four percent of those students spent at least 80% of their school days in a general education classroom (U.S. Department of Education, 2006). Due to an increase in the number of inclusive classrooms across the nation, more general education teachers are charged with educating students requiring special education services within their general education classrooms (Howell, 1996).

Assistive technology (AT) is one way to make the general education curriculum accessible to students with special needs within an inclusive classroom. However, much of the existing literature regarding AT focuses on the knowledge of special education teachers and
other service providers, such as speech language pathologists and occupational therapists. Despite IDEIA’s call for general education teachers to be involved in the IEP process, an increased emphasis on inclusive classrooms, and the role that general education teachers play in educating students with special needs, relatively little is known about the knowledge and skills of general education teachers related to AT. If general education teachers are to contribute to IEPs in terms of suggestions for appropriate interventions, supplements, and modifications, and effectively implement AT into their classrooms, these teachers need an appropriate knowledge base and skillset.

With focus on collaboration between general education and special education teachers, it may be assumed that there would be a comparable knowledge base and skillset between the two groups. However, the current research is lacking in illustrating the extent of AT knowledge elementary general education and elementary special education teachers do or do not share, how that knowledge is acquired, and how collaborative relationships between general and special education teachers impact the decisions that are made related to assistive technology selection and integration. As general and special education teachers share the responsibility for the education of students with special needs, there is a need for more extensive data related to how these two groups of teachers share the decision making space for effective inclusive education that meets the needs of diverse learners.

**Conceptual Framework**

Pedagogical content knowledge, one of the primary categories from Shulman’s (1987) multi-faceted categories of the teacher knowledge base, served as the conceptual framework for this study because pedagogical content knowledge emphasizes a specialized type of knowledge for teaching. Shulman (1987) proposed eight categories of teacher knowledge, including content
knowledge, general pedagogical knowledge, curriculum knowledge, pedagogical knowledge, pedagogical content knowledge, knowledge of the learners, knowledge of educational contexts, and knowledge of educational ends, purposes and values. When viewed in combination with one another, these categories illustrate the rich and varied sources from which the knowledge base for teaching is derived (Shulman, 1987). While pedagogical content knowledge served as the domain of the teacher knowledge base for the conceptual framework within this study, each of these categories of the teacher knowledge base will be described in more detail to illustrate the complexities of the knowledge associated with teaching.

**Shulman’s Categories of the Teacher Knowledge Base**

**Content knowledge.** Content knowledge is comprised of facts and concepts within in a domain (Shulman, 1986). However, according to Shulman (1986), true content knowledge also entails an extensive understanding of the structures within a particular discipline. Thus, to demonstrate content knowledge, a teacher must know not only what an accepted truth is but also why a particular concept is considered justifiable (Shulman, 1986). Having a profound level of content knowledge should allow for the teacher to relate concepts within one domain to other concepts within the same domain and to concepts within other domains (Shulman, 1986). Content knowledge can be represented through Bloom’s cognitive taxonomy and Gagne’s varieties of learning (Shulman, 2004).

**General pedagogical knowledge.** General pedagogical knowledge relates to broad principles of the teaching profession, such as classroom management (Shulman, 1987). Shulman (1987) asserted that this category of teacher knowledge transcends subject matter as the same general pedagogical ideologies may be applied across the curriculum.
**Curricular knowledge.** Shulman (1987) described curricular knowledge as a “grasp of the materials and programs that serve as ‘tools of the trade’ for teachers” (p. 8). Having a strong base in curricular knowledge allows a teacher to implement various instructional alternatives for teaching a concept (Shulman, 1986). Furthermore, Shulman (1986) suggested other key components of curricular knowledge include lateral and vertical curriculum knowledge. Lateral curriculum knowledge entails knowing what curricular materials students are simultaneously studying in other domains, which allows teachers to prompt students to make cross-curricular connections (Shulman, 1986). Vertical curriculum knowledge involves familiarity with the concepts students learned in the same subject area in previous years. This knowledge also includes what students will learn in preceding years and the materials that were and will be used to teach these concepts (Shulman, 1986).

**Knowledge of the learners.** Knowledge of learners includes having a thorough knowledge of students’ preconceptions, misconceptions, and areas of difficulty may impede student learning (Shulman, 2004). An extensive knowledge of relevant features of each student’s gender, language, culture, motivation, prior knowledge, and skill level will assist a teacher in adapting material appropriately for students (Shulman, 2004).

**Knowledge of educational contexts.** Knowledge of educational contexts includes knowledge related the workings of a particular group as well as the workings of a classroom (Shulman, 1987). Knowledge within this category may also include an understanding of the governance and financing of a school district (Shulman, 1987). Pertinent information related to the community surrounding the school and the culture of the school also provides a foundation of contextual knowledge (Shulman, 1987).
Knowledge of educational ends, purposes, and values. Shulman (1987) asserted that the teacher knowledge base also includes the category of educational ends, purposes, and values. This component of the teacher knowledge base entails the philosophical and historical grounds for the purposes and values in the field of education (Shulman, 1987).

Pedagogical content knowledge. Shulman (1987) described pedagogical content knowledge as a “special amalgam of content and pedagogy that is uniquely the province of teachers, their own special form of professional understanding” (p. 8). As it represents a specialized knowledge for teaching, pedagogical content knowledge is the domain of teacher knowledge that serves as the principal conceptual framework for this study. According to Shulman, pedagogical content knowledge is akin to teacher expertise and goes far beyond basic content knowledge (Shulman, 2004). According to Shulman (2004), “Pedagogical content knowledge distinguishes teachers of particular content areas from the educated layman in that area” (p. 404). Pedagogical content knowledge may be thought of as the knowledge required for teaching a particular subject matter (Shulman, 2004). This includes how to represent ideas through analogies, illustrations, explanation, examples, and demonstrations in ways that will make sense to learners (Shulman, 2004). Knowledge of students’ preconceptions and misconceptions plays an integral role in pedagogical content knowledge (Shulman, 2004). Pedagogical content knowledge has been referred to as a “sophisticated professional knowledge” (Ball, Thames, & Phelps, 2008, p. 391) that is essential for quality instruction. This specialized knowledge can be thought of as including nearly everything a teacher might know and use when teaching a given topic (Ball, Thames, & Phelps, 2008). According to Ball, Thames, and Phelps (2008), pedagogical content knowledge can be broken down into the components of knowledge of content and students, knowledge of content and curriculum, and
knowledge of content and teaching. Teachers who possess strong pedagogical content knowledge employ this comprehensive knowledge base throughout the various tasks they complete in order “to support the learning of their students” (Ball, Thames, & Phelps, 2008, p. 395). Such tasks include but are not limited to teaching lessons, planning lessons, assessing student work, creating assessments, communicating with parents, dealing with issues or equity, and working with administrators and colleagues (Ball, Thames, & Phelps, 2008). When teachers exert their pedagogical content knowledge during instruction, they make decisions rapidly to help address students’ needs, thus affirming the need for the appropriate blend of pedagogical and content knowledge as a key component for skillful teaching (Ball, Thames, & Phelps, 2008).

Pedagogical content knowledge in action. When a teacher is teaching a skill such as multi-digit subtraction with regrouping, the content knowledge of how to perform the computation is not sufficient knowledge for effectively teaching the skill to students (Ball, Thames, & Phelps, 2008). A teacher must be able to not only identify incorrect answers and misconceptions, such as when students subtract the top number from the bottom number instead of correctly performing the standard algorithm for regrouping, but teachers must also be able to correct misconceptions that lead to such errors (Ball, Thames, & Phelps, 2008). Such use of pedagogical content knowledge may entail the teacher providing alternative, concrete representations of the mathematical algorithm so that students understand the steps within the calculation procedure and why these steps make sense (Ball, Thames, & Phelps, 2008). When employing pedagogical content knowledge in this scenario, the teacher may integrate manipulatives, strategically choose numbers within a given equation, or implement other conceptually sound, effective pedagogical strategies in order to support student learning (Ball, Thames, & Phelps, 2008). Without the specialized pedagogical content knowledge, the teacher
would not be able to convey the intricacies of this type of mathematical computation in accordance with the needs and abilities of the students (Ball, Thames, & Phelps, 2008).

**Technological pedagogical content knowledge.** Mishra and Koehler (2006) built upon Shulman’s concept of pedagogical content knowledge in the development of the TPACK model – technological pedagogical content knowledge. The TPACK framework includes the ways in which teachers add technology into their knowledge of content and pedagogy (Mishra & Koehler, 2006).

Mishra and Koehler (2006) asserted that TPACK comes into play when teachers use various forms of technology to represent ideas through different illustrations, examples, and demonstrations, a component of pedagogical content knowledge expressed by Shulman (2004). Just as pedagogical content knowledge is the intersection of content knowledge and pedagogical knowledge, technological pedagogical content knowledge is the intersection of content and pedagogy with technology knowledge, technological content knowledge, and technological pedagogical knowledge (Mishra & Koehler, 2006). Technology knowledge includes knowledge of basic technologies, including the necessary skills to operate such forms of technology (Mishra & Koehler, 2006). Technological content knowledge is the knowledge of how specific content may be represented through the incorporation of technology (Mishra & Koehler, 2006). Technological pedagogical knowledge entails the ways in which teaching may be altered as a result of using technology and is “the basis of good teaching with technology” (Mishra & Koehler, 2006, p. 1029). Necessary components of technological pedagogical content knowledge include: using technology in constructive ways in order to teach content; an awareness of how technology can help address student problems in learning; and the knowledge of students’ prior knowledge and how technology can be utilized to strengthen that knowledge
In sum, technological pedagogical content knowledge entails the thoughtful intermingling of content, pedagogy, and technology.

Sources of the Teacher Knowledge Base

In addition to primary categories of teacher knowledge, Shulman (2004) also identified four primary sources for the development of teacher knowledge, including scholarship in content disciplines, educational materials and structures, formal educational scholarship, and the wisdom of practice. These sources of knowledge help illustrate the how the different categories of teacher knowledge are acquired. These sources were integrated into the conceptual framework to help explain how teachers acquire knowledge related to assistive technology.

Scholarship in content disciplines. Scholarship in content disciplines entails being well versed in a given content area (Shulman, 2004). There are two foundations of knowledge for this area: the literature base for the content area and the historical and philosophical nature of knowledge within the discipline (Shulman, 2004). Scholarship in content disciplines includes developing an understanding of the structure of a subject area, how concepts are organized, and the principles of inquiry (Shulman, 2004). A teacher as a member of a scholarly community reflects the notion of scholarship in content disciplines (Shulman, 2004).

Educational materials and structures. Educational materials provide a source for the teacher knowledge base (Shulman, 2004). Such materials include curricula, tests and materials, institutional hierarchies, teaching organizations, and government agencies related to education, governance, and finance (Shulman, 2004). These components may be thought of as “tools of the trade” (Shulman, 2004, p. 229).

Formal educational scholarship. Formal educational scholarship entails delving in to the scholarly literature base related to schooling, teaching, and learning (Shulman, 2004). This
literature base provides pertinent information related to: principles of effective teaching and learning; human development; and the normative, philosophical, and ethical foundations of education (Shulman, 2004). This source of the teacher knowledge base may focus on research that is generic as well as content-specific (Shulman, 2004).

Wisdom of practice. The wisdom of practice includes “the maxims that guide (or provide reflective rationalization for) the practices of able teachers” (Shulman, 2004, p. 232). According to Shulman (2002), the wisdom of practice may be thought of “practical pedagogical knowledge of able teachers” (p. 232). Teachers have an extensive knowledge base related to their wisdom of practice which may be a useful source of knowledge for other practitioners (Shulman, 2002).

Statement of Purpose

The purpose of this study was to explore and describe teachers’ knowledge regarding the selection and implementation of assistive technology in inclusive elementary classrooms. As both general and special education teachers are charged with the education of students with special needs in general education classrooms, both teacher populations were involved within the study to better understand the knowledge and sources of knowledge that go into making decisions regarding assistive technology.

Significance of the Study

This study explored the assistive technology (AT) knowledge of both general elementary educators and elementary special education teachers. The assistive technology knowledge as well as the nature and sources of that knowledge was compared between the two groups. Results from the study may be utilized to guide pre-service experiences and professional development offerings to improve general education and special education teachers’ knowledge related to AT
and other fundamental components related to successful inclusive classrooms. Assistive technology includes tools and strategies useful for meeting the needs of the students with disabilities. If teachers are knowledgeable about appropriate assistive technologies and related strategies, they will be better equipped to meet the educational needs of diverse learners.

**Research Questions**

The overarching research question for this study was: How does the assistive technology knowledge of elementary general education teachers in inclusive classrooms compare to the assistive technology knowledge of elementary special education teachers? Sub-research questions included the following:

1. What do elementary general education teachers know about assistive technology;
2. What do elementary special education teachers know about assistive technology;
3. What are the sources of this knowledge; and
4. What is the nature of teacher knowledge related to assistive technology?

**Assumptions of the Study**

There are several assumptions associated with this study. This study assumed that assistive technology was being integrated to some extent within the schools where the data were collected. During the survey portion of the phase, the researcher assumed that that the respondents answered each item honestly. To address this assumption, participants were made aware of the fact that survey responses would remain confidential. When teachers agreed to participate in focus groups, the researcher assumed that the teachers shared their honest thoughts and experiences and did not falsify or withhold their responses in an attempt to satisfy their colleagues. Focus group participants were informed that when the focus group data were
represented, anonymity would be protected as no participants would be identified by their real names.

**Limitations of the Study**

This study is not without limitations. The population of special education teachers available for the study is far lower than the population of general education teachers due to the fact that there are typically only one or two special education teachers per school. While this sample variance was controlled for during the focus group portion of the study, there were many more general education teachers who responded to the survey than special education teachers as this study occurred within one school system. Thus, this study may not be generalizable to all teacher populations or school systems.

**Definition of Terms**

For the purposes of this study, the following functional definitions have been adopted.

*Assistive technology* – any device intended to support the access to the general education curriculum for a diverse learner

*Elementary general education teacher* – a teacher with a position as a general education teacher who holds a certificate to teach grades Kindergarten through 6th grade

*Elementary special education teacher* – a teacher with a position in special education who holds a certificate in Collaborative Special Education for grades Kindergarten through 6th grade

*Inclusive classroom* – a classroom that includes both nondisabled students and students with special needs

*Individualized Education Plans* – also referred to as IEPs, a legal document that contains information related to a student’s current level of functioning, measurable academic and function goals, and special education services and accommodations
Summary

This dissertation contains five chapters. This first chapter has provided an introduction to the study. In this chapter, the problem was articulated, and the primary research questions for the study were provided. Shulman’s (1986, 1987) categories of teacher knowledge with an emphasis on the category of pedagogical content knowledge and the sources of teacher knowledge were presented as the conceptual framework, which served as the lens through which the data were analyzed. Chapter I also provided an explanation of the significance of the study, identification of limitations and assumptions, and definition of important terms.

Chapter II contains a review of the pertinent literature related to the study. The literature review focuses on concepts related to inclusion, collaboration, and technology in inclusive classrooms, with an emphasis on assistive technology.

Chapter III addresses the research design and other methodological components of the study. This includes a description of the participants and setting for the study. The researcher’s positionality will be addressed. A description of the instruments will be provided, including an explanation of the survey and a list of focus group questions. Data collection and analysis procedures will be described.

Chapter IV presents the results from the data collection phase of the study. Quantitative and qualitative results from the study will be identified. Qualitative themes that emerged from the focus groups will be described.

Chapter V provides a discussion of the results. This discussion includes a summary of the findings in relation to the research questions. Implications of the findings are presented along with recommendations for future research.
CHAPTER II:
REVIEW OF THE LITERATURE

Introduction

This literature review provides insight into the current research base related to inclusion, collaboration, and technology in inclusive classrooms, with an emphasis on assistive technology (AT). Although the literature provides information about the ways in which technology is being utilized in inclusive classrooms, much of the focus is on students, with little explanation of teacher knowledge and how such knowledge is acquired. Little research is available on how collaborative practices and relationships between general and special education teachers influence decisions related to the selection and implementation of assistive technology devices. Additionally, the available literature related to assistive technology provides relatively little insight into the AT knowledge of elementary general education teachers. Most of the available literature related to AT focuses on special education teachers as well as other service providers, such as occupational therapists and speech language pathologists. The lack of existing research strengthens the need for the research associated with this study as general and special education teachers are charged with sharing the decision making space in inclusive education to facilitate learning for students with special needs.

Inclusion

Inclusion entails the welcoming and valuing of all students, in spite of differences. This educational practice of including special education students within general education classrooms is based on the philosophy that “everyone belongs, diversity is valued, and we can all learn from
each other” (Renzaglia, Karvoen, Drasgow, & Stoxen, 2003, p. 140). Part of the supporting notion behind inclusion is that it enables all students, those with and without disabilities, to interact and work together across a multitude of activities, which will prepare students for similar interactions when they become adults (Causton-Theoharis, 2009). In order for inclusive classrooms to be successful, adults working with special needs students, including parents, teachers, and other school personnel, must uphold high expectations and utilize effective practices. Such actions should enable students to maintain inclusionary statuses throughout their lifespans, not merely in an educational setting (Renzaglia, Karvoen, Drasgow, & Stoxen, 2003). The inclusion model provides access to the core curriculum for students with special needs, and this access is enhanced when appropriate accommodations are made (Fisher & Frey, 2001).

There are limited studies relating to the necessary elements for successful school-wide inclusion. However, several studies have been conducted that suggest fundamental elements for effective inclusion (Fuchs, Fuchs, Powell, Seethaler, Cirino, & Fletcher, 2008; Waldron & McLeskey, 2010; Desimone, 2011; McLeskey, Waldron, & Redd, 2012). One of the primary characteristics of schools that have documented successful inclusion is high-quality instruction designed to meet the needs of all students (McLeskey, Waldron, & Redd, 2012). There must also be collaborative relationships, not only between general education and special education teachers, but also among teachers and administrators (Waldron & McLeskey, 2010; McLeskey, Waldron, & Redd, 2012). Collaborative relationships between general and special education teachers can lead to improvements in instructional design for all students (Fisher & Frey, 2001). Successful inclusion requires efficient implementation of resources and shared decision making (Waldron & McLeskey, 2010; McLeskey, Waldron, & Redd, 2012).
Other elements for successful inclusion include instructional decision making that is data driven, which points to the need for consistent, ongoing progress monitoring (Fuchs, Fuchs, Powell, Seethaler, Cirino, & Fletcher, 2008; McLeskey, Waldron, & Redd, 2012). Additionally, teachers in inclusive schools need to participate in high-quality professional development that involves active engagement of teachers as learners (Waldron & McLeskey, 2010; Desimone, 2011; McLeskey, Waldron, & Redd, 2012).

**Teachers’ Inclusive Experiences**

Special education teachers have indicated that a lack of content knowledge is a barrier to helping their students access the general education curriculum, a primary component of inclusive education (Otis-Wilborn, Winn, Griffin, & Kilgore, 2005). These teachers have also cited the needed time to stay in contact with general education teachers as difficult to acquire and maintain (Otis-Wilborn, Winn, Griffin, & Kilgore, 2005). Furthermore, special education teachers serving in inclusive classrooms have noted that receiving lesson plans from general education teachers in advance in order to plan accordingly has been problematic (Otis-Wilborn, Winn, Griffin, & Kilgore, 2005). Special education teachers have also asserted that there tends to be a lack of clarification in teacher roles and responsibilities for both general and special education teachers when teaching in inclusive settings (Otis-Wilborn, Winn, Griffin, & Kilgore, 2005). Meanwhile, some special education teachers have indicated that their general education counterparts have exhibited less than enthusiastic attitudes, which has been a hindrance to successful and effective inclusion (Orr, 2009). Some special education teachers even feel limited by their own knowledge of appropriate inclusive practices, including co-teaching (Orr, 2009).

A qualitative study of general education elementary teachers provided insight into this teacher population’s experiences and beliefs related to inclusion (Fuchs, 2009). The study
concluded that the one of the primary concerns held by general educators in regard to inclusion was a perceived lack of support from the special education teachers. Yet, in another study, general education teachers indicated that special education teachers and related service providers offered ample support (Leatherman, 2007). Some general education teachers believe that they hold the majority of the responsibility for planning and making accommodations for special needs students in comparison with the special education teacher (Fuchs, 2009). In addition, some teachers indicated tension between the general education and special education teachers in their schools (Fuchs, 2009).

General education teachers have also expressed other barriers to inclusion, including limited support from administrators and insufficient training during their pre-service training (Fuchs, 2009). Teachers involved in one study indicated that they were only required to take one special education course during college and that the course failed to prepare them to differentiate instruction, make accommodations, or collaborate with special education personnel (Fuchs, 2009). Yet, teachers in another study reported they had adequate support from administrators (Leatherman, 2007). General education teachers do seem united in their desire for more extensive training related to inclusive practices (Avramidis, Bayliss, & Burden, 2000; Kamens, Loprete, & Slostad, 2000; Leatherman, 2007; Fuchs, 2009).

General and special education teachers have had diverse experiences with inclusion (Otis-Wilborn, Winn, Griffin, & Kilgore, 2005; Leatherman, 2007; Fuchs, 2009). Both teacher groups have indicated tension and a lack of mutual support (Orr, 2009; Fuchs, 2009). The literature supports a need for more extensive training for inclusion and for the establishment of a practical framework that promotes the sharing of the inclusive space as both groups of teachers work collaboratively to meet the needs of all learners.
General Educators’ Training for Inclusion

Studies of general educators’ training for inclusion reveal conflicting results. A study of higher education faculty from 41 states indicated that general education majors do take an introductory course in special education (Harvey, Yssel, Bauserman, & Merbler, 2010). Participants in the study also tended to agree that their general education pre-service programs offered opportunities for collaboration across teaching disciplines and majors. This finding lies in contrast with another study where general education teachers indicated their only pre-service experience with special education training was the one required special education course (Fuchs, 2009). In the opposing study, the general education teachers indicated their pre-service program did not offer opportunities for learning collaboration with special education personnel (Fuchs, 2009). Thus, what little literature exists in the realm of general education teachers’ training for inclusion indicates there may be some disconnect in beliefs between faculty and graduates of teacher preparation programs in regard to ample preparation and training of general education teachers for teaching in inclusive classrooms.

Kosko and Wilkins (2009) conducted a study related to the effect of in-service training on general education teachers’ abilities and efficacy related to making instructional adaptations for students with Individualized Education Plans. The study indicated that the greater the number of professional development hours, the greater the confidence the teachers had in their abilities to adjust their instruction for students with special needs (Kosko & Wilkins, 2009). Eight hours of professional development was shown to be twice as effective for improving teachers’ self-perceived abilities compared to less than eight hours (Kosko & Wilkins, 2009). Kosko and Wilkins (2009) asserted that this was an important finding as teachers’ self-efficacies are directly related to the choices they make in the classroom. Other studies support teachers’ desire for
professional development related to inclusion and making instructional and curricular modifications (Idol, 2006).

**Collaboration**

Inclusive education occurs most effectively in schools that have a collaborative culture (Waldron & McLeskey, 2010). Collaboration entails several defining characteristics. According to Cook and Friend (1991), collaboration entails voluntary interaction between two equal parties. The decision-making process is a shared venture during collaboration, and resources are shared throughout the process (Cook & Friend, 1991). Collaboration involves the two parties working toward a common goal, and both parties will share the accountability for the outcomes (Cook & Friend, 1991).

**Collaborative Practices for Inclusion**

There are multiple forms of collaborative teaching practices designed to support inclusive classrooms. These practices include the consulting teacher model, the cooperative teacher model, supportive resource programs, and instructional assistants (Idol, 2006).

**Consulting teacher model.** The consulting teacher model entails the special education teacher serving in a consultant role to the general classroom teacher (Idol, 2006; Simmons, Carpenter, Dyal, Austin, & Shumack, 2012). Thus, while the special education teacher does not work directly with students with special needs, he or she does so indirectly through consulting with the general education teacher (Idol, 2006). This type of collaboration should include a time for shared planning where the general and special education teacher can work together to create instructional plans targeted to the needs of all learners (Carpenter & Dyal, 2007).

**Cooperative teacher model.** The cooperative teacher model involves the general and special education teacher co-teaching within the same classroom (Idol, 2006; Friend, Cook,
Co-teaching can take a variety of forms, including: lead and support, station teaching, parallel teaching, team teaching, and alternative teaching (Friend, Cook, Hurley-Chamberlain, & Shamberger, 2010; Forbes & Billet, 2012). This collaborative approach entails sharing responsibilities for planning, instructional delivery, and assessment (Carpenter & Dyal, 2007; Fenty, McDuffie-Landrum, & Fisher, 2012).

**Resource programs.** Collaboration through supportive resource programs encompasses special and general education teachers working together to design a student’s program of instruction for the resource room, at which time services are generally provided by the special education teacher (Idol, 2006). While the resource room approach involves the special education teacher providing instruction for students with special needs in a separate room for a small portion of the day, collaboration is a component of this approach through cooperative planning and problem solving for the instruction of students with special needs (Voltz & Elliot, 1990). Despite the use of pull-out programs within the resource model, general and special education teachers still need to utilize collaboration and consultation to increase the potential for student success within the general education classroom (Karge, McClure, & Patton, 1995).

**Instructional assistants.** The instructional assistant approach involves a paraprofessional attending general education classes with students with special needs to provide assistance and support (Idol, 2006). So that paraprofessionals will be effective and efficient, they should be directed and monitored by both general and special education teachers (Dover, 2005). General and special education teachers need to meet regularly with paraprofessionals for planning purposes and to provide feedback (Aurbacher & Morgan, 2001). Paraprofessionals should be
utilized in supportive, supplementary roles; however, they should not make pedagogical decisions (Causton-Theoharis, Giangreco, Doyle, & Vadasy, 2007). Thus, general and special education teachers should both play a role in strategically directing the activities of the paraprofessional to support successful inclusive education (Causton-Theoharis, Giangreco, Doyle, & Vadasy, 2007).

**Collaborative Practices in Action**

A study by Idol (2006) examined collaborative models in practice and surveyed teachers’ views on each of the models. Many teachers indicated that they preferred the resource room approach due to their belief that students with disabilities were best served by being removed from the general education classroom for extra assistance (Idol, 2006). Idol (2006) asserted that educators should be mindful of the data supporting the education of students with disabilities in the general education classroom. Cooperative teaching was utilized by all of the eight schools involved in the study, and most of the teachers asserted that they liked this collaborative instructional practice (Idol, 2006). However, while most teachers indicated that they needed a cooperative teacher, this is generally not a feasible option due to financial constraints (Idol, 2006). Some of the special education teachers involved in the study served as consultants, but this was in addition to their full time role as a teacher of direct instruction (Idol, 2006). Some of the teachers suggested that while paraprofessionals were helpful in the general education classroom setting, these instructional assistants needed more thorough training (Idol, 2006). Classroom teachers indicated a desire for more training on how to utilize the paraprofessionals more efficiently within their classrooms (Idol, 2006).
Technology in Inclusive Classrooms

Inclusive classrooms make use of instructional and assistive technology (King-Sears & Evmenova, 2007). Instructional and assistive technology, when implemented appropriately, can promote aid in the learning process for all students in inclusion classrooms – those with and without disabilities (King-Sears & Evmenova, 2007). Some technologies, such as digital textbooks, may be considered both instructional and assistive (Edyburn, 2002; King-Sears & Evmenova, 2007).

**Instructional Technology**

Instructional technology is a form of technology often utilized with special education and general education students. This type of technology is systematic and is designed to benefit teaching and learning related to specific, content-based objectives (Blackhurst, 2005). According to the U.S. Department of Education (2004), instructional technology is beneficial in helping scaffold student learning as well as in reducing the achievement gap often found in inclusive classrooms. Examples of instructional technology include videotapes, computer-based instruction, electronic books, and the Internet. One should note, in regard to this description of instructional technology, that technology is still only an instructional tool (Blackhurst, 2005). Merely using technology “cannot compensate for instruction that is poorly designed of implemented” (Blackhurst, 2005, p. 176).

**Instructional technology in action.** Students with Autism may have difficulty sitting for long periods of time during traditional, teacher-centered classroom situations (Leach & Duffy, 2009). Therefore, it is essential that teachers of inclusive classrooms provide an array of instructional strategies for these students. Leach and Duffy (2009) identified computers as one of the many instructional strategies that can be incorporated on a daily basis for students with
Autism in inclusive classrooms. Computer-assisted instruction (CAI) is one technology-based application that is thought to be beneficial for students with Autism. CAI entails the presentation of content and/or the monitoring of a student’s knowledge through a computer-based application (Pennington, 2010). Pennington (2010) asserted that one of the major benefits to the use of CAI for students with Autism is that these students tend to show fewer undesirable behaviors when using CAI than when being involved in traditional instructional formats. Furthermore, the enjoyment and motivation for these students tends to be higher with CAI (Pennington, 2010). However, there are some perceived drawbacks to the extensive use of CAI. Students with Autism tend to retreat from social situations (Pennington, 2010). One drawback to CAI is that it may inadvertently increase the isolation of students with Autism (Pennington, 2010). Thus, Pennington (2010) proposed a balance between CAI and group activities in order to keep students with Autism as engaged as possible in social contexts.

Visually-based multimedia programs are growing in popularity for usage with students who have Autism because this population tends to have strong visual perception (Mechling, Gast, & Seid, 2009). While those with Autism have visual acuity, one of their weaknesses lies in their tendencies to require constant prompting (by teachers, aides, peers, etc.) in order to successfully complete tasks. In order to meet this need, a popular usage of technology for this student population is the implementation of self-prompting systems that utilize picture and/or video prompts (Mechling, Gast, & Seid, 2009). This type of technology affords students the cueing they may require in order to successfully complete tasks without the need for extra prompting from another person; therefore, students with Autism may begin to become more independent (Mechling, Gast, & Seid, 2009).
A number of research studies have pointed to positive results for the incorporation of technology with students who have mild learning disabilities (Howell, 1996; Kennedy & Deshler, 2010; Smith & Okolo, 2010). Software is often the technology tool of choice for use with this group of students, and this type of technology intervention has proven results in the content areas of math, word recognition, spelling, health, and problem-solving abilities. Even though there are fewer studies related to reading comprehension, there is increasing evidence that students with learning disabilities may also benefit from software geared toward this more complex skill (Howell, 1996).

Kennedy and Deshler (2010) provided several recommendations for incorporating technology with students who have learning disabilities. Teachers should select multimedia resources that are an extension of the teacher’s existing pedagogy and that explicitly aid students in building the skills necessary for success. Such materials should meet the individual needs of the students while also meeting local and state standards. Additionally, multimedia resources should have minimal extraneous processing and foster active learning. This means that all images and sounds should serve to enhance learning. Kennedy and Deshler (2010) also recommended that selected multimedia-based programs should be designed on the premise of sound learning theories.

Graphic organizers are effective tools for assisting students with learning disabilities in the strengthening of content-area performance (Hall & Strangman, 2003). Technology can play a significant role in affording students with learning disabilities access to graphic organizers through software-based applications, such as Kidspiration, as well as through free web-based applications, such as FreeMind (Smith & Okolo, 2010). The benefit in implementing graphic organizers for students with learning disabilities lies in the fact that the organizers provide a
visual representation as well as highlight the connections among the information (Hall & Strangman, 2003). The connections between and among concepts are what students with learning disabilities tend to miss when attempting to mentally organize content-based information (Hall & Strangman, 2003). Computer-based graphic organizers are typically interactive and therefore may have even greater educational benefits for students with learning disabilities in comparison to traditional, paper-based graphic organizers (Smith & Okolo, 2010).

The writing skills of students with learning disabilities have also shown improvement through the use of technology (Smith & Okolo, 2010). This finding is significant because the writing of students with learning disabilities typically lacks in length, fails to demonstrate organization, has less varied word usage, and tends to contain many spelling and grammatical errors (Mason & Graham, 2008). Recommendations for teaching students with learning disabilities to write included: explicit instruction in the planning, revision, and editing of texts; creating specific, attainable goals for each written assignment; and providing instruction with word processing programs and allowing students to utilize those programs for writing assignments (Graham & Perin, 2007). In addition to basic word processing programs, there are many other technology-based applications that assist students with learning disabilities in the writing process (Graham & Perin, 2007). According to Graham and Perin (2007), computer-based graphic organizers can assist students in planning their ideas for writing through visual mapping. There are also specific programs, such as Draft Builder, which provide support for struggling writers through the writing process (Graham & Perin, 2007). Other programs, such as Co-Writer, identify potential spelling and grammatical errors and even offer sentence starters when needed as a way to scaffold the writing process (Graham & Perin, 2007). Although technology is beneficial in the area of writing, in order to be effective, the technology must be
coupled with the basic components of writing instruction, particularly in the form of direct or explicit instruction (Smith & Okolo, 2010). Researchers have noted that there are software programs that provide direct instruction (Smith & Okolo, 2010). The research related to using technology as a resource for improving writing skills for students with learning disabilities highlights the importance of choosing computer-based applications wisely if such programs are to contribute to students’ successes.

**Assistive Technology**

Assistive technology is one of the most frequently utilized forms of technology for students with special needs. The purpose of assistive technology is to provide students with disabilities “access to the general education curriculum for academic, social, and extracurricular activities” (Dyal, Carpenter, & Wright, 2009, p. 557). Within the school setting, the term assistive technology is used for any device intended to assist or improve the competencies of students who have disabilities. The definition of Assistive Technology included within the Individuals with Disabilities Education Improvement Act (IDEIA) has caused AT to be viewed as a very general concept (Demski, 2008). When the previous legislation was written, AT had to be considered only on the basis of those students who required such devices (Demski, 2008). However, the updated policy requires Assistive Technology to be offered to any student who may need such a device, thus increasing the number of students who qualify for AT (Demski, 2008).

**Types of assistive technology.** Assistive technology is generally divided into the following categories: communication, computer access, daily living, mobility, recreation, reading, writing/spelling, math, and memory/organization (Parette & Wojcik, 2004). Communication-based assistive technology is intended to help the communication skills of those
with speech problems, mental retardation, or writing difficulties (Parette & Wojcik, 2004).

Assistive technology for computer access promotes interaction with computers, often through adaptive keyboards, touchscreens, and specialized software (Parette & Wojcik, 2004). Daily living assistive technology devices assist with activities such as dressing, hygiene, eating, etc. (Parette & Wojcik, 2004). Mobility devices include any products that help with movement and transportation (Parette & Wojcik, 2004). Assistive technology for recreational purposes aids in the participation of sports, social, and cultural events (Parette & Wojcik, 2004). Reading-centered assistive technology includes any device that helps with the access and understanding of printed materials (Parette & Wojcik, 2004). Assistive technology for writing and spelling helps students with special needs communicate through writing in ways that can be understood by others (Parette & Wojcik, 2004). Math-based assistive technology provides support for making mathematical computations, such as with a calculator or the use of manipulatives (Parette & Wojcik, 2004). Assistive technology for memory and organization is designed to assist students with special needs to organize materials, follow a sequence of steps, and utilize a schedule (Parette & Wojcik, 2004).

Assistive technology devices are on a continuum of no tech, low tech, medium tech, and high tech (National Assistive Technology Research Center, 2001). When making assistive technology choices, the National Assistive Technology Research Center (2001) suggested beginning with the low tech side of the continuum and working toward the upper end of continuum as needed. No tech assistive technology includes items that do not require power, while low tech systems include those that require a source of power but are easy to program (Assistive Technology Training Online Project, 2005). Medium tech devices require a power source and require more training for implementation and maintenance of the devices, while high
tech devices are those that require extensive training (Assistive Technology Training Online Project, 2005). No tech and low tech devices can easily be utilized by anyone in the classroom, such as pencil grips, special paper, and highlighters (Kurtts, Dobbins, & Takemae, 2012). Mid tech devices also lend their applications to all students and include devices such as spell checkers, calculators, and digital recorders (Kurtts, Dobbins, & Takemae, 2012). High tech assistive technology is more specialized, such as touch screen computers and special word processing software (Kurtts, Dobbins, & Takemae, 2012). High tech devices, such as computers or special software programs, are more difficult to acquire than low tech devices due to budgeting issues (Demski, 2008). Grants and other funding sources, such as Parent Teacher Associations, are often used to secure extra funding for AT devices (Demski, 2008). While assistive technology consideration is a required component of the IEP process, there is little evidence to support whether or not schools tend to utilize a systematic screening process to determine whether or not students would benefit from assistive technology, and if so, which device(s) would be most appropriate (Edyburn, 2002).

While assistive technology is most frequently utilized with students who have severe disabilities, assistive technology has the untapped potential to be used with other students with special needs, such as those with learning disabilities (Hasselbring & Bausch, 2006). This may be partially due to the fact that assistive technology is used with greater frequency in special education classrooms as opposed to general education classrooms (Hasselbring & Bausch, 2006). However, assistive technology has the potential to meet the needs of diverse learners in general education classrooms (Hasselbring & Bausch, 2006). For example, computer-based software can assist these students in successfully navigating through grade-level texts while the technology also improves their reading skills through scaffolding (Hasselbring & Bausch, 2006).
**Assistive technology toolkits.** The development and implementation of assistive technology toolkits has been identified as a strategy for incorporating an array of assistive technology devices to meet the needs of all learners (Edyburn, 2000; Parette & Wojcik, 2004; Parette, Wojcik, Peterson-Karlan, & Hourcade, 2005; Judge, 2006; Judge, Floyd, & Jeffs, 2008). Assistive technology toolkits serve to equip classrooms with assistive technology devices designed to aid in the teaching and learning process (Edyburn, 2002). Assistive technology toolkits can serve to “quickly deploy tools of obvious value into the hands of teachers and students” (Edyburn, 2000, p. 16). When toolkits are implemented, teachers can allow students to explore relevant devices and collect data related to the associated performance (Edyburn, 2000).

**The utility of assistive technology.** Researchers have analyzed teachers’ perceptions of the utility of specific AT devices within the classroom. In a study of teachers of students with mental retardation, Parette and Wojcik (2004) found the following devices were identified as being of moderate to high utility: books on tape, communication boards, visual schedules, writing with symbols, specialized keyboards, speech recognition software, special word processors, specialized calculators, Kidspiration software for the organization of ideas, reading rulers, number lines, counters, pencil grips, and adapted seating (Parette & Wojcik, 2004). A study of early childhood special education professionals identified the following assistive technology devices as having high levels of usefulness: visual schedules, calendars, and lists; picture communication symbols; Boardmaker software; talking switches; tape recorders; weighted vests; positioning devices; switches; adapted seating; adaptive tables and desks; touch screen computers; pencil grips; talking books; and adaptive keyboards (Judge, 2006). The top ten devices rated as “always useful” in the study included: visual schedule, calendar, and lists; picture communication symbols; Boardmaker software; touch screen for computer; picture
symbol display books/boards; boards with objects, pictures, symbols; adaptive seating; positioning devices; Picture This software; and adaptive keyboards (Judge, 2006).

**An example of assistive technology in action.** A study on the use of Palm computers, a form of assistive technology, in a 6th grade class composed of both general education students and special education students found that the students with special needs were “the strongest users of the handhelds, consistently indicating daily use” (Bauer & Ulrich, 2002, p. 20). Nondisabled students were even able to support their peers with special needs by “beaming them assignments, notes, messages, and prompts” (p. 20). However, the study did show that the special needs students were not consistently using accommodations related to the device that were detailed on their Individualized Education Plans. Despite training in the use of a spell checker and calculator installed on the Palms, the study showed that students used these tools infrequently. When questioned as to why they did not use these accommodating applications, students cited reasons such as laziness, blame on the teacher for not reminding the students to check their spelling, and the ability to ask someone else how to spell words. Overall, the results of the study suggested that the incorporation of Palms was beneficial for the students. However, the researchers suggested that teacher and peer support as well as additional training for students may be crucial to the successful implementation of this type of technology (Bauer & Ulrich, 2002).

**General education teachers and assistive technology.** According to McClaren, Bausch, and Ault (2007), general education teachers have cited multiple barriers regarding Assistive Technology implementation. One such barrier was a fear of technology and unfamiliarity with AT (McClaren, Bausch, & Ault, 2007). Teachers noted that fear and uncertainty stemmed from lack of training (McClaren, Bausch, & Ault, 2007). From a different
perspective, special education teachers indicated that general education teachers were unwilling to learn (McClaren, Bausch, & Ault, 2007). Furthermore, special education teachers have expressed that some general education teachers fail to understand the need for AT as a way to make the general education curriculum accessible to students with disabilities (McClaren, Bausch, & Ault, 2007). Instead, general education teachers may, in certain cases, believe that the technology can be used as an excuse (McClaren, Bausch, & Ault, 2007)

**Special education teachers and assistive technology.** A study by Michaels and McDermott (2003) indicated that special education teacher preparation programs have shown great differences in ideals and practices regarding the integration of Assistive Technology knowledge and skills into coursework and field experiences. The study found that programs used multiple ways of infusing Assistive Technology knowledge into coursework. Some programs included AT information in introductory courses. In other programs, AT was included in introductory special education courses but continued to be strongly emphasized in all subsequent education courses. Some special education preparation programs required students to master AT skills as a course requirement. Some universities offered courses solely on AT. Students also tended to implement AT within field experiences. While these strategies attempt to build special education teachers’ knowledge and skills regarding Assistive Technology, some programs have cited inadequate faculty expertise regarding AT as barrier to effectively integrating AT knowledge, skills, and dispositions into special education preparation courses. Due to the great variance in AT incorporated during coursework, special education teachers do not always graduate with the adequate knowledge, skills, and attitudes necessary to effectively implement Assistive Technology with the students they will serve (Michaels & McDermott, 2003).
A study by Anderson and Petch-Hogan (2001) explored the incorporation of technology during the pre-service training of special education teachers at Southeast Missouri State. The courses in this program were arranged in five blocks, with the final block being the student teaching experience. The researchers found that students were not required to use technology during any field experiences until the fourth block, which was the block utilized for the study. Prior to the field experience during the fourth block, students received two three-hour sessions focusing on appropriate software and hardware related to their field experiences. Students received additional one-on-one instruction when they checked out technology for use in the lessons they were teaching. Students took a survey at the beginning of the semester prior to the technology training and implementation and took another survey at the end of the semester. The survey results indicated students had an increased awareness of available instructional technology. Students also indicated improved abilities in hooking up devices, installing software, and performing basic troubleshooting and maintenance operations on the computer. The participants indicated they did not perceive their abilities to use computers for student assessment improved during the field experience. However, the pre-service teachers did indicate an increased knowledge of available software and hardware available for students with special needs as well as increased abilities in the evaluation of software. The survey responses indicated that students still felt ill-prepared at developing materials for use with adaptive devices and equipment, using speech synthesis in software, and configuring the computer for students with visual impairments (Anderson & Petch-Hogan, 2001).

**Collaboration and assistive technology.** In addition to the difference in the AT knowledge base, a lack of communication between general education and special education teachers has been identified as a barrier to collaborative efforts to implement AT (McClaren,
Bausch, & Ault, 2007). However, teachers indicated collaboration was enhanced when:
relationships were built, the AT implementation process was made easy, training was similar for
both general and special education teachers, educators shared a vision, and willing attitudes were
exhibited by both teacher populations (McClaren, Bausch, & Ault, 2007). Teachers have also
expressed that collaboration is enhanced when colleagues share AT resources and when teachers
feel comfortable enough to ask fellow teachers for AT assistance (Parette, Stoner, & Watts,
2009).

Collaborative efforts related to AT may also occur with parents and other service
providers, such as occupational therapists, speech language pathologists, physical therapists, and
Assistive Technology specialists (McClaren, Bausch, & Ault, 2007). The researchers noted there
was a great variance in the frequency of collaboration, as infrequently as once a year during
Individualized Education Plan meetings to as frequently as daily correspondence (McClaren,
Bausch, & Ault, 2007).

**Barriers to assistive technology implementation in inclusive classrooms.** “When AT
is appropriately integrated into the general education classroom, students are equipped with
multiple means to complete their work and meet their educational goals” (IRIS Center, 2012).
However, several studies have identified barriers that prevent the effective implementation of
assistive technology in general education classrooms (Parette & Murdick, 1998; Kennedy &
Deshler, 2010). Research by Parette and Murdick (1998) identified lack of training,
abandonment of technology, and cost as barriers to the effective implementation of assistive
technology in inclusive classrooms. They concluded that for training to be effective, the training
needs to be ongoing – before, during, and after the receipt of the assistive technology device(s).
Unfortunately, initial training is often the only training that is provided; furthermore, training is
often provided by the technology vendor(s), who is often unavailable for further information
during the actual implementation of the technology (Parette & Murdick, 1998). Even when
training does occur, sometimes it is done in an ineffective manner that negates transfer of the
information into the technology implementation process (Parette & Murdick, 1998).

Research by Kennedy and Deshler (2010) has shown that many teachers often reject new
tools that may not easily fit within their current approaches to teaching and learning. However,
technology is rapidly changing and evolving. If technology in inclusive classrooms is to be
optimized, educators must see technology as beneficial and be willing to stay informed of
technological advances for instruction (Kennedy & Deshler, 2010). Like teachers, students also
need to understand the importance of technological tools for learning. According to Land
(2000), students who fail to recognize technology-based learning tools as beneficial tend to
ignore the tools and may even consider them a deterrent to their success. Thus, teachers must
work with students to assert the importance of technology as a learning tool.

**Assistive technology training outcomes.** According to Parette, Stoner, and Watts
(2009), teachers have indicated that when AT training is provided, they believed their self-
confidence in the implementation of Assistive Technology in their classrooms increased, as did
desir for AT knowledge and skill set. Teachers who have participated in AT professional
development have indicated they view Assistive Technology as a source of engagement for
students with special needs (Parette, Stoner, & Watts, 2009). However, teachers have also
indicated that a lack of time to practice skills in correlation with AT training is a source of
frustration and a barrier to transferring the AT knowledge and skills into the classroom (Parette,
Stoner, & Watts, 2009).
Dissinger (2003) studied an Assistive Technology in-service offering for special educators and therapists in a mid-western state. The study took place over four years. The in-service training was designed for those who made AT decisions and was provided in a face-to-face, hands-on environment by technology specialists at the regional technology center. General AT information, legal issues, augmentative and alternative communication, and computer access were all topics included within the training. The training took place over a four day period; the fourth day was four to six weeks after the first three days of in-service training. At the conclusion of the course, all 244 participants made a 91% or greater on the final examination. A questionnaire was also provided to assess participant satisfaction. All participants indicated that they learned something new that was of benefit related to their students and AT. Participants also indicated that they would recommend the course to a colleague.

Puckett (2004) explored the impact of professional development for special education teachers of grades kindergarten through 8. The study entailed the incorporation of an assistive technology toolkit for students with mild disabilities. The participants participated in one month of web-based training and online discussions related to assistive technology. The training involved simulations and weekly discussion topics. Following the online training, teachers participated in a face-to-face workshop environment that provided educators with 25 hours of direct instruction related to the assistive technology available in the toolkit. The hands-on training also afforded teachers time to develop applications for use with their students.

In a pre-training survey designed to determine teacher knowledge, use, and confidence related to basic assistive technology applications, the majority of participants indicated no knowledge or minimal awareness related to seven out of the eight categories of AT applications. However, a majority of participants indicated they were at a practicing or proficient level in terms of spelling.
and grammar checks for supporting the writing process of special needs students. In the post-workshop surveys, a majority of the participants rated themselves as practicing or proficient for seven out of the eight AT application categories. However, most teachers only indicated an awareness level for the voice recognition software category. A follow-up report from the participants indicated that many of the teachers had begun implementing many of the software and equipment they received during the training. Participants also indicated that they intended to implement the use of other AT during the school year (Puckett, 2004). Hence, this study supports the notion that professional development in the form of an Assistive Technology toolkit can result in increased knowledge, skills, and implementation of AT by special education teachers (Puckett, 2004).

**Models for assistive technology consideration.** There are four research-based models that focus on assistive technology consideration (Edyburn, 2001). These models include: the SETT Framework; Education Tech Points; has technology been considered; and The AT CoPlanner Model (Edyburn, 2001). The SETT framework focuses on gathering information related students’ needs and abilities, consideration of the environment, an analysis of tasks in which the student participants, and contemplation of tools and strategies that might assist the student in the completion of such tasks (Zabala, 1995). Education Tech Points contains six key points to facilitate assistive technology decision making, including: referral, evaluation, extended assessment, plan development, implementation, and periodic review (Bowser & Reed, 1995). The *has technology been considered model* is a flowchart that contains key questions to consider and decisions that must be made during the assistive technology consideration process (Chambers, 1997). The AT CoPlanner Model is a software-based product focusing on collaborative planning (Haines & Sanche, 2000). This model includes electronic worksheets and
planning systems for assistive technology consideration (Haines, Robertson, & Sanche, 2000). Edyburn (2001) asserted that these models have had a significant impact on the assistive technology consideration process in schools. However, the empirical research on assistive technology reviewed for this review of literature did not explicitly include any of these models or provide insight to additional frameworks that were used for the consideration of assistive technology. Thus, there is a lack of evidence related to how assistive technology decisions are made within the inclusive school.

**Applying the Conceptual Framework to the Research Base**

Shulman (1986, 1987) identified the following categories of teacher knowledge: content knowledge, general pedagogical knowledge, curriculum knowledge, pedagogical knowledge, pedagogical content knowledge, knowledge of the learners, knowledge of educational contexts, and knowledge of educational ends, purposes and values. However, the existing research base does little to illuminate the nature of teacher knowledge related to assistive technology through this conceptual lens. While teacher perspective on inclusion and collaboration are present within the research, much of the focus on assistive technology applications is student-centered (Avramidis, Bayliss, & Burden, 2000; Kamens, Loprete, & Slostad, 2000; Otis-Wilborn, Winn, Griffin, & Kilgore, 2005; Leatherman, 2007; Fuchs, 2009; Leach & Duffy, 2009; Kennedy & Deshler, 2010; Mechling, Gast, & Seid, 2009; Pennington, 2010; Smith & Okolo, 2010). Thus, there still remains uncertainty as to what type(s) of teacher knowledge drives the decision-making process related to assistive technology in inclusive classrooms.

Shulman (2004) also identified four primary sources for the development of teacher knowledge, including: scholarship in content disciplines, educational materials and structures, formal educational scholarship, and the wisdom of practice. These sources of knowledge help
illustrate the how the different categories of teacher knowledge are acquired. A small amount of data were available related to assistive technology knowledge gained through professional development and pre-service training (Dissinger, 2003; Michaels & McDermott, 2003; Idol, 2006; McClaren, Bausch, & Ault, 2007; Fuchs, 2009; Kosko & Wilkins, 2009; Parette, Stoner, & Watts, 2009; Harvey, Yssel, Bauserman, & Merbler, 2010). However, this research base is not extensive, and other potential sources of teacher knowledge for assistive technology are absent from the literature.

Summary

The existing research base offers some insight into teacher practices and experiences related to inclusion and collaboration. There are also many studies pointing to the utility of technology. However, most of the focus on the actual application of technology within the classroom is student-centered. Much of the research on assistive technology focuses on special education teachers and related service providers. There are few studies to illustrate how knowledgeable general and special education teachers are regarding assistive technology. While there are existing models available to facilitate the consideration of assistive technology in schools, there is little empirical data to indicate how these models are integrated into the assistive technology decision making process. Furthermore, there is a lack of evidence as to how collaborative relationships between general and special education teachers influence the selection and implementation of assistive technology in inclusive classrooms. The existing research base does not provide detailed insight as to how these two groups of teachers navigate the shared decision making space associated with inclusive classrooms in order to meet the needs of diverse learners. The research base does not provide insight into the types of knowledge that influence assistive technology decisions or the sources of such knowledge (Shulman, 1986, 1987, 2004).
The paucity of existing research within this area strengthens the need for the research associated with this study.
CHAPTER III:

METHODOLOGY

Introduction

This study employed a nonexperimental, mixed-methods approach. A mixed-methods approach entails collecting both quantitative and qualitative data and merging that data (Creswell & Plano Clark, 2006). Utilizing two different data types served to provide a more detailed description of the issues involved in the study (Creswell & Plano Clark, 2006). Collecting both quantitative and qualitative data is a form of methodological triangulation, which can serve to develop more detailed descriptions of the phenomena (Streubert & Carpenter, 2011). Member checking was utilized as part of the triangulation for the qualitative portion of this study. The aim of triangulation is to provide completeness and confirmation of the research findings (Streubert & Carpenter, 2011).

The quantitative data provided a general understanding of the knowledge related to assistive technology for both general and special education teachers (Creswell & Plano Clark, 2006). Quantitative data were collected through online surveys. Surveys were useful for this study as a method of gathering information regarding elementary general and special education teachers’ attitudes, beliefs, and behaviors regarding Assistive Technology (Patten, 2009).

Qualitative data were collected for this study through open-ended survey items and through focus groups. According to Denzin and Lincoln (2000), “Qualitative research is a field of inquiry in its own right” (p. 2). Since little is known about how general education teachers’ knowledge of assistive technology compares to the knowledge of special education teachers,
how such knowledge is acquired, and the nature of the knowledge, the qualitative component of this study allowed for deeper inquiry into these issues. Qualitative methods enhanced this study due to their ability to better understand “perceptions, attitudes, and processes” (Glesne, 2011, p. 39). Thus, open-ended survey items and focus groups provided the researcher with a deeper understanding of general education and special education teachers’ knowledge regarding AT, the nature of assistive technology knowledge, and the sources of that knowledge as teachers share the space in inclusive settings in order to meet the needs of diverse learners. Both general and special education teachers were utilized for the focus groups to allow for the integration of multiple perspectives (Weiss, 1994). The researcher maintained a reflective journal throughout the qualitative data collection phase in order to maintain an awareness of the personal influence she potentially had in this study due to her engagement with the research participants (Streubert & Carpenter, 2011).

The qualitative data from the open-ended survey items and focus groups were coded and analyzed through the conceptual framework for the study, Shulman’s (1986, 1987) concept of pedagogical content knowledge and sources of teacher knowledge. Throughout the data analysis phase, the researcher utilized this framework to analyze the types of teacher knowledge that drive decisions related to assistive technology and the sources of this knowledge. Codes generated by the researcher based on Shulman’s (1986, 1987) concept of pedagogical content knowledge and sources of teacher knowledge utilized during data coding and analysis included: teacher expertise; knowledge of content and students; knowledge of content and curriculum; knowledge of content and teaching; addressing students’ needs; alternative representations; knowledge of technologies; teachers as members of the scholarly community; sources of teacher knowledge; educational materials as tools of the trade; formal educational scholarship; practical
pedagogical knowledge as wisdom of practice; and teachers as sources of knowledge for other practitioners.

Setting

The setting for this study was a school system in Northeast Alabama. This school system was selected for convenience and because this system has numerous inclusive classrooms, a key component for the study. The researcher attained permission of the Superintendent of the school district to conduct research in the school system. The participating schools included the elementary schools and any other schools in the system responsible for the education of students in grades Kindergarten through 6th grade. The school system is comprised of seven elementary schools. Four of the elementary schools are comprised of grades Kindergarten through 6th grade. Two of the elementary schools consist of grades Kindergarten through 4th grade, after which the students attend a middle school. One of the elementary schools is composed of students in grades Kindergarten through 5th grade, and students begin attending the high school in 6th grade. There were 5,035 students in Kindergarten through 6th grade in the school district at the time of this study. Table 1 provides additional demographic data related to the Kindergarten through 6th grade population in school district that served as the setting for this study.
Table 1

School District Demographics

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>American Indian/Alaskan Native</td>
<td>11</td>
<td>.22</td>
</tr>
<tr>
<td>Asian</td>
<td>27</td>
<td>.54</td>
</tr>
<tr>
<td>Black</td>
<td>638</td>
<td>12.70</td>
</tr>
<tr>
<td>Multi</td>
<td>103</td>
<td>2.05</td>
</tr>
<tr>
<td>Not Specified</td>
<td>137</td>
<td>2.70</td>
</tr>
<tr>
<td>Pacific Islander</td>
<td>7</td>
<td>.14</td>
</tr>
<tr>
<td>White</td>
<td>4,112</td>
<td>81.70</td>
</tr>
<tr>
<td>Free/Reduced Lunch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free</td>
<td>2,730</td>
<td>54.20</td>
</tr>
<tr>
<td>Reduced</td>
<td>403</td>
<td>8.00</td>
</tr>
<tr>
<td>Paid</td>
<td>1,900</td>
<td>37.70</td>
</tr>
<tr>
<td>Education Type</td>
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<td></td>
</tr>
<tr>
<td>Special Education</td>
<td>778</td>
<td>15.40</td>
</tr>
<tr>
<td>Gifted</td>
<td>695</td>
<td>13.80</td>
</tr>
<tr>
<td>Regular Education</td>
<td>3,562</td>
<td>70.70</td>
</tr>
</tbody>
</table>

According to the Director of Special Education for the school system, the key word in regard to service delivery related to inclusion within this school district is “collaboration.” The director stated that the school system starts “with the premise that every student’s optimal placement will be 100% general education classes – to the maximum extent appropriate.” She indicated that supports and services to help students maintain the general education placement are provided as needed and that justification is provided within the IEPs for any time that students with special needs are out of the general education classroom. The director articulated that it is the school system’s belief that special education is “a service, not a place.” In order to allow for collaboration, special education teachers and paraprofessionals working within the school system are provided with professional development to assist them in working more
effectively with teachers and students in general education classrooms. It is the district’s belief, according to the Director of Special Education, that “these collaborative personnel are critical to providing help and assistance for students who do not qualify for special education but benefit from reteaching, small group instruction, and the assistance that is possible when there are two teachers in a classroom.” The Director of Special Education asserted the need for general education teachers to perceive all students within their classrooms as “my student” and that general education teachers were bound by what is contained in the students’ IEP documents. Thus, general education teachers are responsible for knowing the specialized needs of each student. The director stated “Inclusion or collaboration has become just the way we do business.

**Researcher Positionality**

Being reflective entails the researcher being mindful of the ways in which he or she conducts research, relates to the participants, and represents the participants within the written product (Charmaz, 2006). As the researcher, I should note that I conducted research in my own backyard (Glesne, 2011). I have had collegial relationships with many of the research participants for several years prior to the study. Therefore, as an insider to the research setting, I realized that I must be supremely aware of my position as a researcher and the implications that my positions as both a researcher and a colleague might have on my research.

Furthermore, as a general education classroom teacher who has taught multiple students with special needs, I feel intimately connected to the topic at hand. Thus, throughout this study, I endeavored to be aware of my own potential biases and preconceptions. As the researcher, I maintained a reflective journal throughout the process. This journal allowed me to reflect on my own thoughts to ensure that I kept these notions separate from the input of my participants.
Participants

The participants for this study were selected through purposeful sampling, due to their experience as general education teachers in inclusive classrooms or as collaborative special education teachers (Creswell & Plano Clark, 2006). Participants for this study were elementary general and special education teachers of grades Kindergarten through 6. Only elementary school teachers were utilized to maintain a sense of focus and clarity throughout the study. If inclusion begins when students enter school, then elementary general and special education teachers are likely to be the first teachers to make assistive technology decisions that impact students with special needs.

All of the participants were teachers working in the seven elementary schools in a school district in Northeast Alabama. Approximately 250 teachers were solicited for the survey through convenience sampling of all teachers within the district who met the criteria of being an elementary general education teacher or an elementary special education teacher. The sample included a greater number of elementary general education teachers as this teacher population is larger than the population of elementary special education teachers. Demographic data collected from the participants included age, current teaching assignment (elementary general education or elementary special education), and years of teaching experience. These demographics were selected because of their pertinence to the topic being studied (Patten, 2011).

Survey participants had the option to indicate their willingness to participate in focus groups. From the survey sample, three focus groups were formed. The researcher planned to schedule six participants for each focus group (Patten, 2011). The first group was comprised of six general education teachers. The second focus group entailed an equal blend of three general and three special education teachers. The researcher intended for six special education teachers
to be involved in the third focus group. However, due to willingness to participate, the third focus group only included four special education teachers. All of the focus group participants were white females.

Instrumentation

Survey

An online survey for this study was created utilizing Survey Monkey. The survey was developed based on the review of the literature related to specific types of assistive technology and Shulman’s framework of teacher knowledge and sources of teacher knowledge. Multiple articles referred to the importance of developing and implementing assistive technology toolkits (Edyburn, 2000; Judge, 2006; Judge, Floyd, & Jeffs, 2008; Parette & Wojcik, 2004; Parette, Wojcik, Peterson-Karlan, & Hourcade, 2005). Additionally, The University of Kentucky Assistive Technology Project (2002), based on six years of research on assistive technology, contains a continuum of considerations for assistive technology for a multitude of areas, including writing, computer access, composing written material, communication, learning and studying, math, recreation and leisure, activities of daily living, mobility, control of the environment, seating and positioning, vision, and hearing. From the available assistive technology toolkits and the University of Kentucky’s Continuum of Considerations (2002), ten assistive technologies, including low-tech and high-tech devices, were selected for inclusion on the survey. For each technology, teachers rated their knowledge and perceived utility through closed-ended questions. Teachers also had to the option to provide a brief description of the how they have implemented the technology and their sources of knowledge related to the technology through open-ended questions. The open-ended questions aided in the validation of the closed-ended items (Creswell & Plano Clark, 2006). Open-ended items sought to address Shulman’s
(1986, 1987) framework for teacher knowledge and sources of teacher knowledge. The survey is located in Appendix B.

The first assistive technology device featured on the survey was a specialized calculator, including talking calculators and those with large keys and displays. The University of Kentucky Assistive Technology Project included this mid-tech technology on its Continuum of Considerations (2002). Multiple assistive technology toolkits feature specialty calculators as an appropriate technology for supporting mathematical computation for students with disabilities (Judge, 2006; Parette & Wojcik, 2004; Parette, Wojcik, Peterson-Karlan, & Hourcade, 2005).

The second assistive technology device included on the survey was a pencil with an adaptive grip, a low-tech form of assistive technology. Pencil grips are generally rubber, triangular grips that fit on a pencil in order to assist students in positioning their fingers correctly and to reduce hand strain (Judge, Floyd, & Jeffs, 2008). The University of Kentucky Assistive Technology Project cited this form of assistive technology as useful for supporting the mechanics of writing (2002). Teachers have rated pencil grips as a form of assistive technology with moderate utility (Judge, 2006; Parette & Wojcik, 2004).

An adaptive keyboard was the third assistive technology device included on the survey. This mid-tech technology includes alternative keyboards that often have larger keys that are spaced farther apart than traditional keys, and the keys are often located alphabetically in contrasting colors to make it easier for users to identify and press the letters and numbers (Judge, Floyd, & Jeffs, 2008). Teachers have asserted that this assistive technology is of moderate to high utility (Judge, 2006; Parette & Wojcik, 2004). The University of Kentucky Assistive Technology Project included this form of assistive technology as a means to support computer access (2002).
The fourth assistive technology incorporated within the survey was a reading ruler. This low-tech tool is often implemented as a strategy for helping students who have difficulty in tracking text while reading (Parette, Wojcik, Peterson-Karlan, & Hourcade, 2005). Teachers have expressed they find reading rulers to be of moderate utility for students with disabilities (Parette & Wojcik, 2005). Many reading rulers contain a highlighted strip, which provides a change in color; such devices were included within the University of Kentucky Assistive Technology Project’s Continuum of Considerations (2002).

Talking word processors were the fifth form of assistive technology included on the survey. This type of word processor allows students to convert speech to text and vice versa (Parette, Wojcik, Peterson-Karlan, & Hourcade, 2005). This high-tech form of assistive technology was featured on the University of Kentucky Assistive Technology Project as a tool for supporting the mechanics of writing (2002). In several studies, teachers have indicated that talking word processors are of high to moderately high utility (Judge, 2006; Parette & Wojcik, 2004).

Adapted seating was the sixth type of assistive technology featured on the survey. This form of assistive technology includes special chairs and cushions to support various seated positions (Judge, 2006). Multiple forms of adapted seating were included within the University of Kentucky Assistive Technology Project’s Continuum of Considerations (2002). Teachers have cited such mechanisms as having moderate utility within the classroom (Parette & Wojcik, 2004). A study by Judge (2006) found adaptive seating as one of the top ten assistive technology devices that teachers rated as “always useful.”

Specialty software for the organization of ideas was included on the survey as the seventh form of assistive technology. Such high-tech software allows students to create semantic webs
and produce a visual plan for creating outlines in order to support the writing process (Parette, Wojcik, Peterson-Karlan, & Hourcade, 2005). Teachers have indicated they find this type of software to be of moderately high utility for students with disabilities (Parette & Wojcik, 2004). Software for the organization of ideas and studying was included in the University of Kentucky Assistive Technology Project’s Continuum of Considerations in the area of learning and studying (2002).

The eighth form of assistive technology on the survey was math manipulatives, including an abacus or Math Line, counters, and a number line. In a study by Parette and Wojcik (2004), teachers rated a number line and counters as having moderate utility for students with disabilities. The University of Kentucky Assistive Technology Project’s Continuum of Considerations for the area of Math included an abacus or Math Line as a low-tech form of assistive technology to support the attainment of math concepts and skills (2002).

Talking books were the ninth type of assistive technology included on the survey. These books allow students to hear the texts read aloud. Audible texts are available for both textbooks and leisure texts (Parette, Wojcik, Peterson-Karlan, & Hourcade, 2005). This high-tech technology was at the peak of the University of Kentucky Assistive Technology Project’s Continuum of Considerations (2002) in the area of reading. Teachers asserted that books on tape, one form of talking books, are of high utility for students with disabilities (Parette & Wojcik, 2004). Another study concluded teachers found talking books to be of moderate utility for young children (Judge, 2006).

The tenth and final form of assistive technology on the survey was visual schedules, calendars, and lists. This low-tech assistive technology includes pictures and/or symbols that are representative of activities and tasks as a way to help students understand and regulate their day
The University of Kentucky Assistive Technology Project’s Continuum of Considerations included picture schedules as the first tool to consider for the area of learning/studying (2002). A study by Judge (2006) concluded that teachers found visual schedules, calendars, and lists as the assistive technology for communication with the highest level of usefulness. In the study, it was the leading technology on the top ten devices rated as “always useful” by participants (Judge, 2006). A study by Parette and Wojcik (2004) reflected teachers’ beliefs that visual schedules are of high utility.

Focus Groups

The aim of the three focus groups was to explore the types of teacher knowledge that impact assistive technology decisions and implementation and the sources of that knowledge (Shulman, 1986, 1987). Shulman’s (1986, 1987) categories and sources of teacher knowledge provided the framework for the development of many of the focus group questions.

The following questions were utilized as guiding questions for the first focus group, which included six elementary general education teachers. Participants’ responses and interactions also drove the discussion. Since teachers were discussing specific uses of assistive technology, copies of the survey that the teachers completed during the first phase of the study were provided to aid in the facilitation of these focus group questions. The questions include the following:

1. How do you make decisions related to when to use assistive technology with special needs students in your classroom;

2. How do you make decisions related to how to use assistive technology with special needs students in your classroom;
3. How do you acquire assistive technology tools and strategies for meeting the needs of diverse learners;

4. What has been your experience as a participant in the development of the assistive technology portion of IEPs for students with special needs;

5. Based on the survey, what are your overall opinions on the utility of assistive technology;

6. Are there any devices on the survey, which you have found to be particularly effective? If so, please elaborate;

7. Have you received any training or professional development on assistive technology? If so, please describe the experience; and

8. Where and how have you acquired the knowledge related to assistive technology devices?

The following questions were utilized as guiding questions for the second focus group, which was comprised of a blend of three elementary general education teachers and three elementary special education teachers. As with the previous focus groups, participants’ responses and interactions drove the discussion. The questions included

1. How do you make decisions related to the selection and implementation of assistive technology;

2. How do you work together as general and special education teachers to make assistive technology decisions in order to meet the needs of your students with special needs;

3. What types of assistive technology have you implemented;

4. What successes have you had in using assistive technology;
5. What barriers do you have with selecting and implementing assistive technology;
6. What are your thoughts on the value of assistive technology; and
7. What are your needs in order to utilize assistive technology more effectively?

The following questions were utilized as guiding questions for the third group, which included only elementary special education teachers. Participants’ responses and interactions drove the discussion. Since teachers were discussing specific uses of assistive technology, copies of the survey that the teachers completed during the first phase of the study were provided to aid in the facilitation of these focus group questions. The questions included

1. How do you ensure that students with special needs on your caseload are receiving the assistive technology devices and services as outlined within their IEPs;
2. Describe how you acquire assistive technology tools and strategies for meeting the needs of diverse learners;
3. In what ways do you include general education teachers in the development of the assistive technology portion of IEPs;
4. What are your opinions on the utility of assistive technology;
5. Are there any devices on the survey, which you have found to be particularly effective? If so, please elaborate;
6. How do you make assistive technology decisions for students’ IEPs; and
7. After assistive technology is selected, what procedures do you use for implementing the technology?
Data Collection

Prior to any data collection, the researcher submitted the details for the study to the University of Alabama’s Institutional Review Board (IRB) for approval. The IRB process served to protect the rights of the research participants and to ensure that the study is ethically sound.

Surveys

During the first phase of data collection, all general and special education teachers who met the criteria were contacted through e-mail to request their participation in the study. Prior to sending the survey to participants, the researcher piloted the survey with four teachers – two with a background in elementary general education and two with a background in elementary special education. The pilot was used to determine if the questions were clear to the participants, if the answer choices allowed the participants to respond the questions in a way they find to be appropriate, and to calculate an approximate length of time that the survey would take to complete. Once the survey pilot was complete, an e-mail was sent to participants with a link to the online survey, which was administered through Survey Monkey. The survey data stored on Survey Monkey were password protected and encrypted for security. Only the researcher had access to the data. Any hard copies of the data were kept in a locked filing cabinet in the researcher’s office. Follow-up e-mails were sent to prospective participants in order to encourage participation and secure an appropriate sample for the study.

Focus Groups

After survey data were collected, focus groups were conducted with selected participants who asserted their willingness to participate in a focus group via the online survey. Participants were selected based on their experience with assistive technology. Those teachers who indicated
they had some experience with assistive technology had priority in the selection for focus groups as these participants were likely to have more to offer during the focus groups.

The guiding questions for the focus group were generated based on the review of the literature related to assistive technology, inclusion, collaboration, and Shulman’s categories of teacher knowledge. Three focus groups were formed. One group was comprised solely of elementary general education teachers. A second group was formed with a blend of general and special education teachers. The third focus group was composed of only elementary special education teachers.

**Data Analysis**

The quantitative items on the survey were analyzed with the Statistical Program for the Social Sciences software (SPSS). A statistical analysis of the data was utilized to describe trends in the data and compare the two groups – general education teachers and special education teachers (Creswell & Plano Clark, 2006). Descriptive statistics were utilized to report demographic data. Data analysis of the quantitative items on the surveys included \( t \)-tests and chi-square. The \( t \)-tests were conducted to compare the mean scores between general education teachers and special education teachers. Chi-square was utilized to determine whether or not the opinions of general education teachers and special education teachers were significantly different. Reliability was calculated using Cronbach’s alpha. Since the survey contained open-ended components, the qualitative data contained within the survey were coded for their relation to Shulman’s (1986, 1987, 2004) categories of teacher knowledge and sources of teacher knowledge.

Each of the three focus groups was audio recorded and transcribed by the researcher. The researcher then summarized the data through analytical memos. The analytical memos were
shared with the focus group participants via e-mail. Member validation was utilized to add validity to qualitative data (Kvale & Brinkmann, 2009). This process allowed the researcher to ensure that the ideas of participants were represented accurately, which added an element of trustworthiness to the data (Glesne, 2011). Then, the data were coded through the lens of Shulman’s (1986, 1987, 2004) categories of teacher knowledge.

At the end of the data analysis phase, the analysis of the quantitative data gathered from the survey and analysis of the qualitative data gathered from the focus groups was merged (Creswell & Plano Clark, 2006). The researcher assessed whether or not the two data sets were convergent or divergent based on whether or not the quantitative data supported the emergent themes from the qualitative data or if the data sources resulted in conflicting findings (Creswell & Plano Clark, 2006). This process allowed for data comparisons and interpretations to be made when discussing the findings for each individual research question (Creswell & Plano Clark, 2006).

**Summary**

Table 2 includes a summary of how the methodology for the study was implemented in order to address each of the research questions.
## Research Questions and Methodology

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>What do elementary general education teachers know about assistive technology?</td>
<td>The survey provided the quantitative data for this research question. During the survey, teachers rated their familiarity with specific assistive technology devices. Participants had the opportunity to provide an explanation of how they have incorporated these technologies, which provided an additional layer of data related to their knowledge of assistive technology. Focus groups revisited this topic to gather additional data.</td>
</tr>
<tr>
<td>What do elementary special education teachers know about assistive technology?</td>
<td>The survey provided the quantitative data for this research question. During the survey, teachers rated their familiarity with specific assistive technology devices. Participants had the opportunity to provide an explanation of how they have incorporated these technologies, which provided an additional layer of data related to their knowledge of assistive technology. Focus groups revisited this topic to gather additional data.</td>
</tr>
<tr>
<td>What are the sources of this knowledge?</td>
<td>During the survey, participants had an open-ended opportunity to explain the ways in which they have learned about the assistive technology devices featured in the survey. Additionally, questions presented during the focus groups inquired about the ways in which teacher knowledge of assistive technology is acquired. Shulman’s (2004) sources of teacher knowledge provided the framework for the analysis of data related to this question.</td>
</tr>
<tr>
<td>What is the nature of this knowledge?</td>
<td>Both the survey and the focus groups provided data for this research question. The open-ended survey items and the focus group transcriptions were coded through the lens of Shulman’s (1986, 1987) categories of teacher knowledge.</td>
</tr>
</tbody>
</table>
This nonexperimental, mixed-methods study collected and analyzed quantitative and qualitative data in order to address research questions related to teacher knowledge of assistive technology. Participants included general education and special education teachers of grades K-6 who had experience with inclusive classrooms. The study took place in a school system in Northeast Alabama.

Quantitative data were collected through closed-ended survey items. Qualitative data were collected via open-ended survey items and three focus groups. A statistical analysis of the qualitative data was conducted. All qualitative data were coded and analyzed through the lens of Shulman’s (1986, 1987, 2004) categories and sources of teacher knowledge. A combination of data types, along with member checking of qualitative data and a reflective journal kept by the researcher, added triangulation, a sense of completeness, and credibility to the data (Streubert & Carpenter, 2011).
CHAPTER IV:

RESULTS

Introduction

The purpose of this study was to explore and describe teachers’ knowledge regarding the selection and implementation of assistive technology in inclusive elementary classrooms. As both general and special education teachers are charged with the education of students with special needs in general education classrooms, both teacher populations were included as participants within this study in order to better understand the knowledge and sources of knowledge that go into making decisions regarding assistive technology. The overarching research question for the study was: How does the assistive technology knowledge of elementary general education teachers in inclusive classrooms compare to the assistive technology knowledge of elementary special education teachers? This mixed-methods study utilized a survey to collect both quantitative and qualitative data and three focus groups to collect qualitative data. This chapter provides the data analyses and results from the data collection phase of the study.

Survey Data

Demographics

The researcher-developed survey on assistive technology was distributed to all Kindergarten through 6th grade general education teachers and collaborative special education teachers in the school district which served as the setting for the study. In addition to current teaching assignment, other demographics included within the study were age and years of teaching experience. Table 3 provides the frequency and percentage of teachers based on current
teaching assignment. Table 4 indicates the age ranges of the respondents. Table 5 includes the years of teaching experience of the participants.

Table 3

*Demographics for Current Teaching Assignment*

<table>
<thead>
<tr>
<th>Current Teaching Assignment</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Elementary Teacher</td>
<td>61</td>
<td>77.2</td>
</tr>
<tr>
<td>Elementary Special Education Teacher</td>
<td>18</td>
<td>22.8</td>
</tr>
</tbody>
</table>

Table 4

*Demographics Related to Age*

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 – 29 years old</td>
<td>16</td>
<td>20.3</td>
</tr>
<tr>
<td>30 – 39 years old</td>
<td>34</td>
<td>43.0</td>
</tr>
<tr>
<td>40 – 49 years old</td>
<td>21</td>
<td>26.6</td>
</tr>
<tr>
<td>50 – 59 years old</td>
<td>8</td>
<td>10.1</td>
</tr>
</tbody>
</table>

Table 5

*Demographics Related to Years of Experience*

<table>
<thead>
<tr>
<th>Years of Teaching Experience</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 5 years</td>
<td>21</td>
<td>26.6</td>
</tr>
<tr>
<td>6 – 10 years</td>
<td>21</td>
<td>26.6</td>
</tr>
<tr>
<td>11 – 15 years</td>
<td>16</td>
<td>20.3</td>
</tr>
<tr>
<td>16 – 20 years</td>
<td>13</td>
<td>16.5</td>
</tr>
<tr>
<td>21 – 25 years</td>
<td>3</td>
<td>3.8</td>
</tr>
<tr>
<td>26 or more years</td>
<td>5</td>
<td>6.3</td>
</tr>
</tbody>
</table>
Reliability

In order to establish reliability of the survey instrument, Cronbach’s alpha was calculated. The resulting reliability coefficient was .822. The validity of the instrument is supported based upon the value being greater than .80 (Carmines & Zeller, 1979).

Teacher Knowledge and Implementation of Specific Devices

The survey asked each teacher to rate his or her familiarity with ten different assistive technology devices. Teachers also rated their perception of the value of each device. For each assistive technology device featured on the survey, there were two open-ended items for teachers to describe how they have implemented the particular device and how they gained knowledge related to each device, if applicable. These open-ended questions were optional, and the number of responses varied from device to device. Some of the open-ended responses did not address what was being asked and were therefore excluded from inclusion in the analysis. The ten devices featured on the survey were strategically chosen due to their prominence in the literature related to assistive technology toolkits (Edyburn, 2000; Judge, 2006; Judge, Floyd, & Jeffs, 2008; Parette & Wojcik, 2004; Parette, Wojcik, Peterson-Karlan, & Hourcade, 2005). The University of Kentucky’s Assistive Technology Project (2002), a continuum of considerations for assistive technology for a multitude of areas based on six years of research on assistive technology, also provided data supporting the inclusion of many of the devices featured on the survey.

Specialized calculators. Figure 1 shows the differences in familiarity with specialized calculators between general and special education teachers. Figure 2 provides a representation of how these two teacher group perceive the value of specialized calculators. Since the sample of general education teachers was much larger than the sample of special education teachers, the
figures are based on the percentages of responses from each teacher group. Table 6 summarizes the ways in which elementary general and special education teachers indicated they have learned about and implemented specialized calculators.

![Bar chart](image1.png)

**Figure 1.** Teacher Familiarity with Specialized Calculators

![Bar chart](image2.png)

**Figure 2.** Teacher Perception of the Value of Specialized Calculators
### Table 6

**Sources of Knowledge and Implementation of Specialized Calculators**

<table>
<thead>
<tr>
<th>Special Education Teachers’ Sources of Knowledge</th>
<th>General Education Teachers’ Sources of Knowledge</th>
<th>Implementation by Special Education Teachers</th>
<th>Implementation by General Education Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workshops; special education articles; learning through trial and error; being provided with the resource by the central office</td>
<td>The special education department; reading about the resource</td>
<td>For assisting verbal and non-verbal students to promote math skills and understanding; for students unfamiliar with number recognition; for students with visual impairments and learning disabilities</td>
<td>As a tool for problem solving; for students with visual impairments and Autism, as well as other special education students in math class</td>
</tr>
</tbody>
</table>

**Pencils with adaptive grips.** Figure 3 shows the differences in teacher familiarity and implementation related to pencils with adaptive grips. Figure 4 indicates teachers’ perceptions of the value of pencils with adaptive grips. Since the sample of general education teachers was much larger than the sample of special education teachers, the figures are based on the percentages of responses from each teacher group. Table 7 summarizes the ways in which elementary general and special education teachers indicated they have learned about and implemented pencils with adaptive grips.
Figure 3. Teacher Familiarity with Pencils with Adaptive Grips

Figure 4. Teacher Perception of the Value of Pencils with Adaptive Grips
Table 7

*Sources of Knowledge and Implementation of Pencils with Adaptive Grips*

<table>
<thead>
<tr>
<th>Special Education Teachers’ Sources of Knowledge</th>
<th>General Education Teachers’ Sources of Knowledge</th>
<th>Implementation by Special Education Teachers</th>
<th>Implementation by General Education Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning through trial and error; from occupational therapists; through research; by collaborating with other teachers</td>
<td>In a college course; from occupational therapists; online resources; from special education teachers; by collaborating with other teachers</td>
<td>For helping students develop proper technique and pencil position; to help with letter formation; for students with weak fine motor skills and for those with sensory needs; for students who receive occupational therapy services</td>
<td>For helping students learn how to properly hold pencils; for students with motor skills delays; for students with poor handwriting</td>
</tr>
</tbody>
</table>

**Adaptive keyboards.** Figure 5 illustrates teacher familiarity and implementation regarding adaptive keyboards. Figure 6 shows the teachers’ assessment of the value of adaptive keyboards. Since the sample of general education teachers was much larger than the sample of special education teachers, the figures are based on the percentages of responses from each teacher group. Table 8 summarizes the ways in which elementary general and special education teachers indicated they have learned about and implemented adaptive keyboards.
Figure 5. Teacher Familiarity with Adaptive Keyboards

Figure 6. Teacher Perception of the Value of Adaptive Keyboards
Table 8

*Sources of Knowledge and Implementation of Adaptive Keyboards*

<table>
<thead>
<tr>
<th>Special Education Teachers’ Sources of Knowledge</th>
<th>General Education Teachers’ Sources of Knowledge</th>
<th>Implementation by Special Education Teachers</th>
<th>Implementation by General Education Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning through trial and error; the Assistive Technology Specialist at the central office; during undergraduate coursework; other special education teachers</td>
<td>Technology conferences; colleagues; special education teachers</td>
<td>With students with visual impairments, students with weak fine motor skills</td>
<td>With students with visual impairments, those who need assistance with written expression, and students who have language processing issues</td>
</tr>
</tbody>
</table>

**Reading rulers.** Figure 7 demonstrates the differences in teacher familiarity and implementation associated with reading rulers. Figure 8 illustrates the perceived value of reading rulers by elementary general and special education teachers. Since the sample of general education teachers was much larger than the sample of special education teachers, the figures are based on the percentages of responses from each teacher group. Table 9 summarizes the ways in which elementary general and special education teachers indicated they have learned about and implemented reading rulers.
Figure 7. Teacher Familiarity with Reading Rulers

Figure 8. Teacher Perception of the Value of Reading Rulers
Table 9

Sources of Knowledge and Implementation of Reading Rulers

<table>
<thead>
<tr>
<th>Special Education Teachers’ Sources of Knowledge</th>
<th>General Education Teachers’ Sources of Knowledge</th>
<th>Implementation by Special Education Teachers</th>
<th>Implementation by General Education Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catalogs; independent research, undergraduate coursework; colleagues</td>
<td>Special education teachers; colleagues; online research; reading articles about dyslexia</td>
<td>To help students focus; for reading texts across all settings; for students with dyslexia</td>
<td>For students in intervention; to assist students with visual perception problems and those who have difficulty tracking print; to help students stay focused</td>
</tr>
</tbody>
</table>

**Talking word processors.** Figure 9 shows the differences in familiarity with talking word processors between the two teacher groups. Figure 10 illustrates the value general and special education teachers associate with talking word processors. Since the sample of general education teachers was much larger than the sample of special education teachers, the figures are based on the percentages of responses from each teacher group. Table 10 summarizes the ways in which elementary general and special education teachers indicated they have learned about and implemented talking word processors.
Figure 9. Teacher Familiarity with Word Processors

Figure 10. Teacher Perception of the Value of Talking Word Processors
Table 10

Sources of Knowledge and Implementation of Talking Word Processors

<table>
<thead>
<tr>
<th>Special Education Teachers’ Sources of Knowledge</th>
<th>General Education Teachers’ Sources of Knowledge</th>
<th>Implementation by Special Education Teachers</th>
<th>Implementation by General Education Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning through trial and error; from a parent; professional development; resource provided through the central office; from other special education teachers; reading articles; catalogs</td>
<td>School administrators; special education teachers; research</td>
<td>For students with Autism to help students increase their word usage and output; for assisting students with LD and MR in written expression; for non-verbal students to communicate wants and needs</td>
<td>To assist English language learners; for the development of language skills</td>
</tr>
</tbody>
</table>

Adapted seating. Figure 11 illustrates teacher familiarity and implementation related to adapted seating. Figure 12 shows the value general and special education teachers associate with adapted seating. Since the sample of general education teachers was much larger than the sample of special education teachers, the figures are based on the percentages of responses from each teacher group. Table 11 summarizes the ways in which elementary general and special education teachers indicated they have learned about and implemented adapted seating.
Figure 11. Teacher Familiarity with Adapted Seating

Figure 12. Teacher Perception of the Value of Adapted Seating
Table 11

Sources of Knowledge and Implementation of Adapted Seating

<table>
<thead>
<tr>
<th>Special Education Teachers’ Sources of Knowledge</th>
<th>General Education Teachers’ Sources of Knowledge</th>
<th>Implementation by Special Education Teachers</th>
<th>Implementation by General Education Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Assistive Technology Specialist at the central office; recommendations from parents and specialists; research; training sessions; internships; occupational therapists; teacher collaboration</td>
<td>Catalogs; seeing the use of adapted seating in other classrooms; special education teachers</td>
<td>For students who need additional support in sitting; for students with Autism as part of a sensory diet; for students with ADHD</td>
<td>For a student with a skin disease who had difficulty sitting in the floor; for students with special needs</td>
</tr>
</tbody>
</table>

**Software for students to use to organize their ideas.** Figure 13 demonstrates the differences in teacher familiarity and implementation associated with software for students to use to organize their ideas. Figure 14 shows the teachers’ assessment of the value of software for students to use to organize their ideas. Since the sample of general education teachers was much larger than the sample of special education teachers, the figures are based on the percentages of responses from each teacher group. Table 12 summarizes the ways in which elementary general and special education teachers indicated they have learned about and implemented software for students to use to organize their ideas.
Figure 13. Teacher Familiarity with Software for Students to Use to Organize Their Ideas

Figure 14. Teacher Perception of the Value of Software for Students to Use to Organize Their Ideas
Table 12

Sources of Knowledge and Implementation of Software for Students to Use to Organize Their Ideas

<table>
<thead>
<tr>
<th>Special Education Teachers’ Sources of Knowledge</th>
<th>General Education Teachers’ Sources of Knowledge</th>
<th>Implementation by Special Education Teachers</th>
<th>Implementation by General Education Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning through trial and error; colleagues; conferences; college coursework; independent research</td>
<td>College courses; colleagues; workshops; learning through hands-on experience</td>
<td>For students to summarize the ideas in a lesson; projects for student learning; for students to outline writing assignments and to present research</td>
<td>As a tool for student presentations; for students to use at the end of science units; for students to summarize books that they have read; for students who struggle with writing assignments</td>
</tr>
</tbody>
</table>

Math manipulatives. Figure 15 demonstrates teacher familiarity and implementation related to math manipulatives. Figure 16 illustrates the perceived value of math manipulatives by elementary general and special education teachers. Since the sample of general education teachers was much larger than the sample of special education teachers, the figures are based on the percentages of responses from each teacher group. Table 13 summarizes the ways in which elementary general and special education teachers indicated they have learned about and implemented math manipulatives.
Figure 15. Teacher Familiarity with Math Manipulatives

Figure 16. Teacher Perception of the Value of Math Manipulatives
Table 13

*Sources of Knowledge and Implementation of Math Manipulatives*

<table>
<thead>
<tr>
<th>Special Education Teachers’ Sources of Knowledge</th>
<th>General Education Teachers’ Sources of Knowledge</th>
<th>Implementation by Special Education Teachers</th>
<th>Implementation by General Education Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workshops; colleagues; professional development; college courses; independent research</td>
<td>College courses; colleagues; workshops/ professional development; special education teachers; AMSTI (Alabama Math, Science, and Technology Initiative) training</td>
<td>Daily use; to provide concrete objects to use with abstract skills; to provide visual and physical examples; to assist students who have a lack of number and operational sense; for hands-on learning</td>
<td>To increase student engagement; for students who need visual and hands-on models; to assist with number sense; to teach counting, addition, and subtraction, to help students understand concepts; to teach division, multiplication, decimals, percentages, and fractions, for every area taught in math; to reach all types of learners; as a bridge to mental math</td>
</tr>
</tbody>
</table>

**Talking books.** Figure 17 shows the differences in teacher familiarity with talking books. Figure 18 indicates teachers’ perceptions of the value of talking books. Since the sample of general education teachers was much larger than the sample of special education teachers, the figures are based on the percentages of responses from each teacher group. Table 14 summarizes the ways in which elementary general and special education teachers indicated they have learned about and implemented talking books.
Figure 17. Teacher Familiarity with Talking Books

Figure 18. Teacher Perception of the Value of Talking Books
Table 14

Sources of Knowledge and Implementation of Talking Books

<table>
<thead>
<tr>
<th>Special Education Teachers’ Sources of Knowledge</th>
<th>General Education Teachers’ Sources of Knowledge</th>
<th>Implementation by Special Education Teachers</th>
<th>Implementation by General Education Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colleagues; workshops/professional development; textbook committee meetings; collaboration with other teachers; undergraduate coursework; research</td>
<td>Colleagues; college coursework; classroom experience; professional development; through studies on learning styles</td>
<td>For students to see the connection between print and spoken word; for auditory learners; to assist students who are below grade level in comprehension; for students with dyslexia and students with visual impairments</td>
<td>With struggling readers; to enhance comprehension skills; for individualized, small group, and whole group activities and instruction; for auditory learners; as a model for reading fluency and pronunciation</td>
</tr>
</tbody>
</table>

**Visual schedules, calendars, and lists.** Figure 19 illustrates teacher familiarity and implementation regarding visual schedules, calendars, and lists. Figure 20 indicates how general and special education teachers perceive the value of visual schedules, calendars, and lists. Since the sample of general education teachers was much larger than the sample of special education teachers, the figures are based on the percentages of responses from each teacher group. Table 15 summarizes the ways in which elementary general and special education teachers indicated they have learned about and implemented visual schedules, calendars, and lists.
Figure 19. Teacher Familiarity with Visual Schedules, Calendars, and Lists

Figure 20. Teacher Perception of the Value of Visual Schedules, Calendars, and Lists
Table 15

Sources of Knowledge and Implementation of Visual Schedules, Calendars, and Lists

<table>
<thead>
<tr>
<th>Sources of Knowledge</th>
<th>Implementation by Special Education Teachers</th>
<th>Implementation by General Education Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training related to Autism; conferences; workshops; colleagues; independent research; teacher collaboration; school-wide implementation</td>
<td>With students (especially those with Autism) to reduce anxiety and allow for the processing of the day’s activities; to help students change behaviors and allow the teacher to teach instead of dealing with inappropriate behaviors</td>
<td>To increase structure in the classroom; for students with organizational difficulties; to teach about the passage of time; for visual learners; visual cue cards for transitions; for classroom management</td>
</tr>
</tbody>
</table>

Differences in Knowledge and Perceptions of Utility of Assistive Technology

A t-test indicated a significant difference in the knowledge of assistive technology between elementary general education teachers and elementary special education teachers, $t (77) = -4.058$, $p < .001$. The $p$ value of less than .05 indicates a significant difference between these two teacher groups in regard to knowledge of assistive technology. This indicates that elementary special education teachers have a higher level of knowledge regarding assistive technology compare to elementary general education teachers. A t-test did not suggest that there is a significant difference in the perceived value of assistive technology between elementary general education teachers and elementary special education teachers, $t (77) = -1.006$, $p = .317$. The $p$ value of greater than .05 suggests no significant difference between the two teacher groups in relation to the perception of value of assistive technology. Thus, both teacher groups associate similar levels of value with assistive technology. The sample size for both t-tests was 79.
An ANOVA indicated that there were no significant differences in the knowledge of and perceived utility for assistive technology among different age ranges. Table 16 illustrates the results from the ANOVA regarding age. Likewise, an ANOVA suggested no significant differences in the knowledge of and perceived utility of assistive technology based on years of teaching experience. Thus, age and years of teaching experience do not appear to impact the knowledge of or value associated with assistive technology. Table 17 presents the results of the ANOVA based on the numbers of years of teaching experience.

Table 16

*Analysis of Variance for Age*

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>139.803</td>
<td>3</td>
<td>46.601</td>
<td>1.273</td>
<td>.290</td>
</tr>
<tr>
<td>Within Groups</td>
<td>2745.134</td>
<td>75</td>
<td>36.602</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2884.937</td>
<td>78</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Significant at the $p < 0.05$ level.

Table 17

*Analysis of Variance for Years of Teaching Experience*

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>289.477</td>
<td>5</td>
<td>57.895</td>
<td>1.628</td>
<td>.163</td>
</tr>
<tr>
<td>Within Groups</td>
<td>2595.459</td>
<td>73</td>
<td>35.554</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2884.937</td>
<td>78</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Significant at the $p < 0.05$ level.
Relationships with Demographics and Individual Items

Analysis using chi-square was completed to determine if there were any significant relationships between demographics – age, years of experience, current teaching assignment – and the individual survey items. There was a significant relationship found between age and familiarity with adapted seating, $\chi^2(9, N = 79) = 18.370, p = .031$. There was also a significant relationship found between age and perceived utility of using adapted seating, $\chi^2(6, N = 79) = 14.442, p = .025$. Teachers in the lower age range brackets were more familiar with adapted seating and also rated the value of adapted seating higher than older teachers and those with more years of experience. There were no other significant relationships between age and any other assistive technology devices. Chi-square indicated no significant relationships between years of teaching experience and any of the assistive technology devices included on the survey.

Chi-square indicated multiple significant relationships between current teaching assignment and various assistive technology devices. There was a significant relationship between teaching assignment and familiarity with specialized calculators, $\chi^2(3, N = 79) = 17.586, p = .001$. Special education teachers had a significantly higher level of knowledge related to specialized calculators than elementary general education teachers. Chi-square also found a significant relationship between teaching assignment and familiarity with pencils with adaptive grips, $\chi^2(3, N = 79) = 8.707, p = .033$. Special education teachers had a significantly higher level of familiarity with pencils with adaptive grips compared to elementary general education teachers. Additionally, there was a significant relationship between current teaching assignment and familiarity with adaptive keyboards, $\chi^2(3, N = 79) = 10.209, p = .017$. Elementary special education teachers appeared to be significantly more familiar with adaptive keyboards than elementary general education teachers. There was a significant relationship shown between
teaching assignment and familiarity with talking word processors, $x^2 (2, N = 79) = 8.624, p = .013$. Elementary special education teachers were significantly more knowledgeable about talking word processors than elementary general education teachers. Chi-square also indicated a significant relationship between teaching assignment and familiarity with adapted seating, $x^2 (3, N = 79) = 17.850, p < .001$, as well as with teaching assignment and perceived utility of using adapted seating, $x^2 (2, N = 79) = 5.987, p = .050$. Elementary special education teachers had a significantly higher level of familiarity with adapted seating and value associated with adapted seating compared to elementary general education teachers.

**Focus Group Data**

Three focus groups were conducted with purposively selected elementary special education teachers and elementary general education teachers. The elementary general education teachers were chosen because of their recent experiences with inclusive classrooms. Representatives from both teacher groups were purposively selected to represent a variety of grade levels, schools, and years of experience. Purposeful selection was utilized with the goal of attaining rich data that were representative of the teacher knowledge base and experiences related to assistive technology in inclusive classrooms. The first focus group was comprised of six elementary general education teachers. The second focus group consisted of three elementary general education teachers and three elementary special education teachers. Four elementary special education teachers participated in the third focus group.

The first two focus groups were held at one of the local schools. The third focus group was conducted online in a virtual format. During each focus group, the facilitator posed seven to eight open-ended questions to the participants. With consent from the participants, the sessions were audio recorded.
After each session, the facilitator transcribed each session in its entirety. Analytic memos were written by the researcher and shared with participants via e-mail, as a form of member checking, to ensure that participants’ responses were accurately understood and represented. Transcriptions were coded, using Shulman’s (1987) concept of pedagogical content knowledge, Shulman’s (2004) sources of the teacher knowledge base, and the research questions as a guide for identifying themes in the data. From these frameworks, the researcher developed the following codes: teacher expertise; knowledge of content and students; knowledge of content and curriculum; knowledge of content and teaching; addressing students’ needs; alternative representations; knowledge of technologies; teachers as members of the scholarly community; sources of teacher knowledge; educational materials as tools of the trade; formal educational scholarship; practical pedagogical knowledge as wisdom of practice; and teachers as sources of knowledge for other practitioners. From coding the data with this list of codes, the following themes emerged from the data: struggling with student differences; collaborative practices; documentation as a toolbox; individualized access to content and curriculum; lack of professional development and training; finding one’s own knowledge; importance of communication; teacher involvement in the IEP process; and the role of related service providers.

**Struggling with Student Differences**

A recurring theme, particularly from the general education teachers, was the constant struggle that they, as teachers, face when trying to meet the needs of diverse learners in an inclusive classroom. One general education teacher asserted that she makes decisions regarding the use of assistive technology when students are “not succeeding at whatever you’re asking them to do.” Another general education teacher reaffirmed the notion that it becomes an issue
“when they can’t perform the things that their peers do.” The struggle with having so many needs in one classroom was described as enough to make one teacher feel “like pulling my hair out” as she described how students’ “needs are getting more and more differentiated” and that she has “never had so much difference in one class, ability wise.” She went on say, “You basically have to have a plan for every one of your kids.”

**Collaborative Practices**

Collaboration was a term frequently utilized by both general education teachers and special education teachers during all three of the focus groups. When discussing how assistive technology decisions are made, one general education teacher explained that she goes to other teachers, explains the problem(s) she is having, and asks for suggestions based on their experiences. This teacher said who she goes to depends on what the problem is and who she knows might have had related experiences. Another general education teacher discussed the ways in which the special education teacher at her school has provided many resources this year for a particular student with Autism. She stated, “I would go to them and tell them what he was struggling with, and she would pull something out.” Another general education teacher described going to the previous teacher of a student having difficulty, and explained that often her colleagues say, “Here you go; this is what we’ve been using in the past.” Other general education teachers confirmed that collaborating with students’ previous teachers is a practice that they frequently utilize. One general education teacher said her knowledge of many devices and strategies has come from “collaboration with co-workers...you heard somebody talking about it so you go and ask.” Experience was a term utilized by one general education teacher when describing who she decides to seek out for collaboration.
The theme of collaboration was not limited to usage by only the general education teachers. The special education teachers involved in the focus groups also frequently referred to collaborative practices. One special education teacher discussed how collaboration occurs at “the formal IEP meeting to discuss all the needs and concerns of the students” as well as during “an informal conversation.” Another special education teacher described how she will “block out some extra collaborative time” for a child that may be in need of assistive technology or who is having a new implementation of an assistive technology device. When describing how assistive technology tools and strategies are acquired, another special education teacher asserted that she uses “past experience and collaboration to think of what assistive technology would benefit a student.” This special education teacher also referred to “daily collaboration and collection of teacher input” to make decisions related to students with special needs in inclusive classrooms.

**Documentation as a Toolbox**

The general education teachers involved in the focus groups frequently referred to the helpfulness of documentation regarding the assistive technology devices and strategies related to their students with special needs. During the focus group of solely general education teachers, one general education teacher stated that the information “documented on their IEPs is very helpful for the next year’s teacher.”

This theme continued into the focus group that was comprised of three general education teachers and three special education teachers. During this focus group, one of the special education teachers was discussing how some simple forms of assistive technology, such as pencil grips, are not always mentioned in the IEP because when she sees a child in need of something so basic, she “can whip one out” and give it to the student and “then we don’t have to rewrite the
IEP for that.” One of the general education teachers immediately stated, “It would really be helpful if those things were documented.” This exchange led into a discussion about potential ways to document devices and strategies aside from what is in the IEP so that students’ future teachers have an awareness of tools and strategies that have been implemented in the past. One general education proposed turning the “Reading and Math Profile sheet” used by teachers at her school into a more generalized “student profile sheet.” Another general education agreed saying, “That is something to think about. There’d be a lot we could learn, you know, if there was a student profile sheet for the next year’s teacher.” One of the special education teachers asserted her potential opposition to this stating, “Just because that child did not do well in your class, just because he was a behavior issue, you get this sheet and all you see is this poor behavior. He does this wrong. He doesn’t do this. He can’t stay in his seat, and he comes to your classroom and he’s the star student. And just as humans, we’re so eager to prejudge that student.” The general education teacher who proposed the idea of the student profile sheet responded saying that she did not think that the teachers at her school were going to prejudge and said, “…as far as pencil grips and those kinds of things…if you’ve got a heads up on those kinds of things. I’m not going to give a kid something until he shows me that he needs in. Just some kind of background information – this is what’s been used in the past, that kind of thing.” Another general education teacher referred to this informal documentation as serving as “a toolbox for the teacher.”

The theme of documentation as a toolbox suggests that teachers are considering their own knowledge and how that knowledge may be useful for other teachers. Additionally, whereby the special education teacher asserted her concern over the implementation of a general student profile sheet, teachers may also be how sharing their knowledge may have both positive and negative implications for students.
Individualized Access to Content and Curriculum

Both general and special education teachers referred to assistive technology as a way to provide individualized access to the content and curriculum being taught in the general education classroom. When discussing the use of a specialized calculator by a student with special needs, one general education teacher stated, “He cannot multiply, divide, or add like other students can, so he’s allowed to use his calculator so he can do that math that the other students are doing.” In discussing this same type of calculator, one of the special education teachers discussed how the use of the calculator “is a life skill that they’re going to need to learn” and how it also helps students “feel that success that they can do it independently.” Another general education teacher referred to how most of her students have moved on from using base ten blocks to using the hundreds chart but that she has one student who has not. The teacher stated, “You know, you give her a problem to add 20, she’s going to add two. Obviously she doesn’t understand place value, so I have to break out the base ten blocks.” When discussing math manipulatives, one of the special education teachers pointed out how these no and low tech devices can give students a “format they can see, touch, and manipulate.”

One of the special education teachers described how a specialized mouse helped a student with motor skills. She stated, “He had CP, and he couldn’t move the mouse. He could move the ball, and then there were two big buttons. He could just slap it. He could work the computer. It gave him some freedom to play some games.” A general education teacher described how a student who had a hard time using the pencil and who “would become extremely frustrated” used a laptop, which helped her “be successful in class.” When describing the recent implementation of adapted seating in the form of a gel seat, one of the general education teachers described how the student using the seat had “some independence that we haven’t seen this year, so it’s really,
really good” as she explained how the seat enables him to join his classmates in the floor for certain lesson components. One of the special education teachers reiterated the value of adapted seating in the focus group comprised of only special education teachers when she stated that this type of seating “allows students to be a part of a group on the floor” or “the ability to stay seated longer and maintain focus.”

When discussing the value of assistive technology, one special education teacher suggested that assistive technology “helps level the children out, makes them a little more equal…yet individuals.” Another special education teacher said she believes assistive technology is beneficial because it “helps some students in struggling academic areas with gaps in education” and that assistive technology devices “provide good accommodations for students.” Yet another special education teacher discussed the way assistive technology “gives students the opportunity to participate with the regular education students” and “assists in bridging the gap within their learning environment.” Through these discussions, general and special education teachers were asserting their use of assistive technology as a tool to help diverse learners access the content and curriculum.

**Differences in Professional Development and Training**

When the group of general education teachers was asked whether or not they had ever received any professional training on the assistive technology devices, the response was a unanimous “no,” followed by laughter. One of the general education teachers described an experience when she was handed a special microphone to wear for a student with a hearing impairment. She received the device the day before school started and felt like it was “here you go, figure it out.” When discussing how to use assistive technology devices, another general education teacher stated, “There’s not anybody that comes out and tells you how to use it.”
During the blended focus group of general and special education teachers, one of the special education teachers referred to the assistive technology specialist for the district as “the queen of assistive technology.” When asked if this specialist provided professional development one of the special education teachers said “no.” One of the other special education teachers said professional development was not provided “county wide but when I’ve had to do something like that, she would come out and work with me, when it’s something specific for a specific child.”

During the focus group consisting of only special education teachers, one of the special education teachers not involved in the blended focus group specifically referred to “professional development” as a source of her knowledge related to assistive technology.

**Finding One’s Own Knowledge**

The differences in experience with professional development and training regarding assistive technology led into the theme of teachers finding their own knowledge regarding this topic. Multiple general education teachers referred to “online research,” “Google” and “trial and error” as strategies for learning about assistive technology devices and how to effectively implement those devices. One general education teacher suggested “YouTube…how to” as a means for learning the strategies necessary for integrating assistive technology into the classroom. During the special education teacher focus group, one of the special education teachers also referred to YouTube videos for “how to use devices and ideas for variations.”

Another special education teacher cited “college classes” and “independent research” as sources of her assistive technology knowledge. Both teacher groups cited the need for “knowledge” and “professional development” in order to more effectively select and implement assistive technology devices and services.

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This theme suggests that teachers have recognition of that which they do not know. Teachers also show an understanding of when tools and strategies that they have implemented are not effective for getting through to particular students with diverse needs. When these teachers seek out their own knowledge, they are showing initiative as they try to acquire the knowledge necessary to ensure that all students are successful with the content and curriculum.

**Importance of Communication**

Communication was a recurring theme that both teacher groups suggested was necessary for using assistive technology to meet the needs of students with special needs in inclusive classrooms. During the focus group of general education teachers, one teacher was discussing how she had researched strategies for a student with Autism who was constantly asking questions during class, which was a disruption for the other students. She found a Boardmaker picture that served as a quiet card, as well as some other visual cards that she felt suited his needs. The teacher then stated that the special education teacher told her not to use them. The general education teacher appeared frustrated that was no rationale given by the special education teacher. Another general teacher brought up her interaction with a special education teacher in related instances. This general education teacher said, “You know what I say to her…I’m not trying to be disrespectful, but I need to know why we’re doing this. Give me some research, and she’ll whip it right out to you. And now I understand it better. I’m like, oh, okay, that makes sense…no hard feelings or anything. But I think we just have to have that mutual respect for each other. Because if you understand why, that sounds like a plan to me!” The other general education teachers echoed their agreement to these statements, affirming the importance of respectful communication between general and special education teachers.
During the blended focus group, one of the special education teachers referred to the importance of “having an open line of communication with the general ed and special ed teacher” when discussing communication regarding assistive technology devices that may not be formally listed in a student’s IEP. Meanwhile, another special education teacher described the importance of communication and cooperation “from parents being willing and other teachers and paraprofessionals being willing to try it and follow through.”

During the focus group composed of special education teachers, one of the participants discussed how she reminded her teachers about the devices that are to be used in the classroom. She stated she “continues this process throughout the year”, suggesting ongoing communication between herself and the general education teacher. Another special education teacher mentioned “reviewing the students’ services” with the general education teacher to “make sure they are aware of any assistive technology devices.” All three focus groups reinforced the concept of ongoing communication as a key to successful assistive technology integration in inclusive classrooms.

**Teacher Involvement in the IEP Process**

The focus groups included much discussion of the teachers’ roles in the development of the assistive technology portion of IEPs. General and special education teachers appeared to have differing views on the ways in which general education teachers participate in the development of the assistive technology portion of IEPs for students in the special education program.

During the focus group of general education teachers, the consensus was that general education teachers were not included in the development of the assistive technology portion of students’ IEPs. Teachers used words like “nothing,” “zero,” and “never” to describe their
involvement in this process. The teachers went on the say that they did not feel like they were involved in the development of any of the other components of students’ IEPs. Several of the teachers stated that they did not understand how the goals were developed and how normally it is the next year’s teacher that attends the IEP meeting but that they believed the students’ current teachers should be involved as well. When asked about their role in attending end of the year IEP meetings, one general education teacher suggested their roles were “to sign a paper…to meet the parents…to make the parents feel comfortable about the next year.” Other teachers asserted their agreements.

Meanwhile the special education teachers suggested a more integral role of general education teachers in the development of the assistive technology portion of students’ IEPs. During the blended focus group, one of the special education teachers discussed the formal IEP meeting as a forum during which general education teachers and special education teachers “discuss all the needs and concerns of the students and that can sometimes spark ideas of what assistive technology is needed.” During the focus group consisting of only special education teachers, there were multiple references to “teacher input surveys” prior to the development of IEPs. One special education teacher discussed “meeting as a team” and allowing “everyone to give their input on making decisions.”

The Role of Related Service Providers

References to related service providers, generally occupational and physical therapists, were commonplace during the focus groups involving special education teachers. When discussing the acquisition of specific assistive technology devices, several special education teachers cited “OT” (occupational therapists) and “PT” (physical therapists). One special education teacher even pondered “if maybe OT has their own plan that we don’t see.” When
discussing the implementation of an adapted seat in the form of a gel cushion, one special education teacher remarked “It was an OT/PT decision whether or not he used that seat. We didn’t even know he could use that seat and it wouldn’t break down his skin until the PT provider told us. Again, that’s knowledge that has to come to us for us to be able.” After discussing how this seat had previously been in use and then was removed before she came to be employed at the school, the special education went on to say, “It was up to the PT provider to tell either the special ed teacher or the general ed teacher that that’s a device that needs to be utilized for him.”

**Summary**

In summary, this chapter presented the analyses and results from the data collection regarding the assistive technology knowledge of elementary general education teachers and special education teacher. Statistical analyses of the survey data were presented along with the qualitative data collected during the survey. The major themes from the focus groups were identified and described.

Chapter V will provide a discussion of these results as they relate to the study’s research questions. Implications resulting from the study will be discussed. Limitations of the study will be identified. Suggestions for future research will be provided.
CHAPTER V:
DISCUSSION OF RESULTS

Introduction

The purpose of this study was to explore and describe teachers’ knowledge regarding the selection and implementation of assistive technology in inclusive elementary classrooms. The overarching research question for this study was: How does the assistive technology knowledge of elementary general education teachers in inclusive classrooms compare to the assistive technology knowledge of elementary special education teachers? Sub-research questions included the following:

1. What do elementary general education teachers know about assistive technology;
2. What do elementary special education teachers know about assistive technology;
3. What are the sources of this knowledge; and
4. What is the nature of teacher knowledge related to assistive technology?

In order to address this primary research question and the four sub-research questions, this nonexperimental, mixed methods study entailed data collection from elementary general and special education teachers via an online survey as well as through three focus groups. Chapter IV presented the results from the data collection phase of the study. This chapter will discuss those results as related to the research questions. The discussion of these results will include the relationship of the findings to the conceptual framework of Shulman’s (1986, 1987) concept of pedagogical content knowledge and the sources of the teacher knowledge base. Additionally,
implications from the study will be addressed. Limitations of the study will be identified, and suggestions for future research will be provided.

Discussion of Findings

Research Question 1

The first research question was, what do elementary general education teachers know about assistive technology? In order to address this question, elementary general education teachers completed a survey during which they rated their familiarity with specific assistive technology devices (1 = No Familiarity, 2 = Familiar With, 3 = Implemented, 4 = Expert User). During the survey, elementary general education teachers also had an opportunity to elaborate on how they incorporated the specific technologies in their classrooms. In addition to rating their familiarity with the specific assistive technology devices, elementary general education teachers also rated their perception of the value of each assistive technology device (1 = Worthless, 2 = Somewhat Valuable, 3 = Extremely Valuable). Additional data related to this topic was gathered during the focus group portion of the study.

Table 18 shows the means of familiarity general education teachers indicated they had with the ten assistive technology devices featured on the survey. The mean for most of the devices fell between the levels of No Familiarity and Familiar With. Math manipulatives had the highest mean at 3.02, indicating an overall familiarity rating of slightly above Implemented. The findings related to familiarity with the specific assistive technology devices on the survey indicated that while teachers have some familiarity with many of these devices, the teachers did not indicate a level of knowledge associated with the actual implementation of the devices.
Table 18

**General Education Teachers’ Familiarity with Assistive Technology Devices**

<table>
<thead>
<tr>
<th>Assistive Technology Device</th>
<th>Mean of Familiarity for Elementary General Education Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialized Calculators</td>
<td>1.51</td>
</tr>
<tr>
<td>Pencils with Adaptive Grips</td>
<td>1.93</td>
</tr>
<tr>
<td>Adaptive Keyboards</td>
<td>1.21</td>
</tr>
<tr>
<td>Reading Rulers</td>
<td>2.18</td>
</tr>
<tr>
<td>Talking Word Processors</td>
<td>1.41</td>
</tr>
<tr>
<td>Adapted Seating</td>
<td>1.46</td>
</tr>
<tr>
<td>Software for Students to Use to Organize Their Ideas</td>
<td>2.67</td>
</tr>
<tr>
<td>Math Manipulatives</td>
<td>3.02</td>
</tr>
<tr>
<td>Talking Books</td>
<td>2.77</td>
</tr>
<tr>
<td>Visual Schedules, Calendars, and Lists</td>
<td>2.61</td>
</tr>
</tbody>
</table>

Table 19 illustrates the means of the perception of value associated with each of the assistive technology devices by elementary general education teachers during the survey. The mean of perceived value for all of the devices fell between the ratings of *Somewhat Valuable* and *Extremely Valuable*. Thus, while elementary general educators do not have high levels of familiarity with many of the assistive technology devices featured on the survey, they do perceive that the devices have potential value for benefitting students with special needs in their classrooms. Perhaps elementary general education teachers believe that these devices may be helpful at assisting their students in the general education classroom even though the tools are often unfamiliar.
The focus groups provided additional insight regarding the knowledge base of elementary general education teachers related to assistive technology. Elementary general education teachers asserted that they use assistive technology when students are not successful with the tasks they have been given or “when they can’t perform the things that their peers do.” This calls to mind Shulman’s (1986) concept of pedagogical content knowledge as this requires going beyond the content because teaching to students with special needs in a general education classroom may be very different than teaching to their peers who do not have disabilities. Thus, general education teachers appear to use their knowledge of their students in conjunction with
the knowledge of the curriculum and not just knowledge of content in order to drive the assistive technology decision making process.

Focus group data also supported the notion that elementary general education teachers find assistive technology beneficial for helping students access the content and curriculum in a general education classroom. One teacher even spoke of using visual cue cards for students “that were not special ed.” Another general education teacher spoke of reading rulers as a “huge help” for the students she had the previous year. One teacher discussed how valuable manipulatives and specialized calculators had been at helping her students with special needs to be successful with the content being taught in her classroom. Additionally, another general education teacher spoke of the positive experiences one of her students had with using a laptop instead of a pencil to complete written assignments. She described how the student “would become extremely frustrated” when using a pencil but how the implementation of the laptop “just helped her be successful in class.” In a study by McClaren, Bausch, and Ault (2007), general education teachers asserted that sometimes technology can be used as an excuse. Yet, in contrast, in this study, the general education teachers viewed assistive technology as a tool for success.

However, utilizing multiple forms of assistive technology to make the content and curriculum accessible and to truly adjust instruction based on the needs of diverse learners can be difficult when the knowledge of assistive technology is lacking. Much of the discussion by general education teachers during the focus groups was related to specialized calculators and math manipulatives, which also had the highest rating of familiarity by this teacher population during the survey. However, as indicated by the survey results, general education teachers lacked familiarity or were somewhat familiar with many of the devices but did not have a broad enough knowledge base to have implemented the assistive technology devices. The general
education teachers involved in the focus group unanimously agreed that they had not received any formal professional development training on how to implement assistive technology in the classroom, which helps provide insight as to why their knowledge base regarding assistive technology may be lacking. This finding was similar to that of another study where general education teachers cited a lack of training as a source of fear of and unfamiliarity with assistive technology (McClaren, Bausch, & Ault, 2007). Elementary general education teachers did indicate that they seek to supplement this deficiency in their knowledge base by doing “online research” in order to acquire strategies that would benefit diverse learners.

**Research Question 2**

The second research question was: What do elementary special education teachers know about assistive technology? In order to address this question, elementary special education teachers completed a survey during which they rated their familiarity with specific assistive technology devices (1 = *No Familiarity*, 2 = *Familiar With*, 3 = *Implemented*, 4 = *Expert User*). During the survey, elementary special education teachers also had an opportunity to elaborate on how they incorporated the specific technologies in their classrooms. In addition to rating their familiarity with the specific assistive technology devices, elementary special education teachers also rated their perception of the value of each assistive technology device (1 = *Worthless*, 2 = *Somewhat Valuable*, 3 = *Extremely Valuable*). Additional data related to this topic were gathered during the focus group portion of the study.

Table 20 shows the means of familiarity special education teachers indicated they had with the ten assistive technology devices featured on the survey. The mean for most of the devices ranged from the rating of *No Familiarity* to *Implemented*. Math manipulatives had the highest mean at 3.39, indicating a familiarity level between *Implemented* and *Expert User*. The
results indicated that the special education teachers involved in the survey have a familiarity with many of the devices and have a working knowledge of some of the devices that they have implemented.

Table 20

*Special Education Teachers’ Familiarity with Assistive Technology Devices*

<table>
<thead>
<tr>
<th>Assistive Technology Device</th>
<th>Mean of Familiarity for Elementary Special Education Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialized Calculators</td>
<td>2.28</td>
</tr>
<tr>
<td>Pencils with Adaptive Grips</td>
<td>2.50</td>
</tr>
<tr>
<td>Adaptive Keyboards</td>
<td>1.78</td>
</tr>
<tr>
<td>Reading Rulers</td>
<td>2.22</td>
</tr>
<tr>
<td>Talking Word Processors</td>
<td>1.83</td>
</tr>
<tr>
<td>Adapted Seating</td>
<td>1.94</td>
</tr>
<tr>
<td>Software for Students to Use to Organize Their Ideas</td>
<td>2.94</td>
</tr>
<tr>
<td>Math Manipulatives</td>
<td>3.39</td>
</tr>
<tr>
<td>Talking Books</td>
<td>3.22</td>
</tr>
<tr>
<td>Visual Schedules, Calendars, and Lists</td>
<td>2.89</td>
</tr>
</tbody>
</table>

Table 21 illustrates the means of the perception of value associated with each of the assistive technology devices by elementary general education teachers during the survey. The mean of perceived value for all of the devices was between the rating of *Somewhat Valuable* and *Extremely Valuable*. This indicates that elementary special education teachers perceive assistive technology devices as valuable tools for assisting the diverse learners on their caseloads.
Table 21

*Special Education Teachers’ Perceived Value of Assistive Technology Devices*

<table>
<thead>
<tr>
<th>Assistive Technology Device</th>
<th>Mean of Perceived Value by Elementary Special Education Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialized Calculators</td>
<td>2.29</td>
</tr>
<tr>
<td>Pencils with Adaptive Grips</td>
<td>2.44</td>
</tr>
<tr>
<td>Adaptive Keyboards</td>
<td>2.44</td>
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<tr>
<td>Reading Rulers</td>
<td>2.44</td>
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<tr>
<td>Talking Word Processors</td>
<td>2.44</td>
</tr>
<tr>
<td>Adapted Seating</td>
<td>2.50</td>
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<tr>
<td>Software for Students to Use to Organize Their Ideas</td>
<td>2.50</td>
</tr>
<tr>
<td>Math Manipulatives</td>
<td>2.83</td>
</tr>
<tr>
<td>Talking Books</td>
<td>2.83</td>
</tr>
<tr>
<td>Visual Schedules, Calendars, and Lists</td>
<td>2.78</td>
</tr>
</tbody>
</table>

The focus group phase of the data collection process provided additional insight into the assistive technology knowledge base of elementary special education teachers. For the special education teachers involved in the study, the implementation of their assistive technology knowledge base may be automatic as one special education teacher discussed how she could “whip out” a basic device, such as a pencil grip, to quickly meet the needs of one of her students. Special education teachers have knowledge of assistive technology as a tool that can help students access the curriculum. This was evident through one special education teacher’s discussion of how incorporating a specialized mouse assisted a student with Cerebral Palsy in having “some freedom to play some games” and another special education teacher’s dialogue on
how her students who have used specialized calculators have experienced “success that they can do it independently.” These examples of the implementation of assistive technology by elementary special education teachers allude to Shulman’s (1986) notion of pedagogical content knowledge as special education teachers rely on a knowledge base that is all encompassing of not only what is being taught and how to teach it but also the unique, diverse needs and abilities of the students. As described by one of the special education teachers, assistive technology is beneficial for students with special needs in inclusive classrooms because it “assists in bridging the gap within their learning environment.”

Special education teachers also appear to have a knowledge of related service providers in the selection and implementation of assistive technology devices. Multiple special education teachers during the open-ended survey items and during the focus groups cited the role of OT (occupational therapists) and PT (physical therapists) as suppliers of specific assistive technology devices. This teacher population also discussed how outside agencies sometimes provide assistive technology devices that can benefit students at school. As one special education teacher stated, “Sometimes it’s being creative and figuring out how to get it.” The focus on collaborative relationships with related service providers in this study was reminiscent of similar findings by Parette, Stoner, and Watts (2009) that suggested collaboration is enhanced when colleagues share their assistive technology resources and knowledge.

Research Question 3

The third research question was, what are the sources of this knowledge? During the survey portion of the study, both elementary general and special education teachers had the option of responding to open-ended questions regarding the ways in which they learned about the specific assistive technology devices featured in the survey. Additionally, focus group questions
posed to both teacher groups inquired about the ways in which knowledge related to assistive
technology was acquired. Shulman’s (2004) sources of the teacher knowledge base served as the
framework for analyzing data related to this research question.

During the open-ended survey responses, general education teachers cited the following
as their sources of knowledge for the assistive technology devices: special education teachers,
reading about the resources, occupational therapists, online resources, research, collaboration
with other teachers, catalogs, college courses, workshops and professional development, AMSTI
(Alabama, Math, Science, and Technology Initiative) training, and conferences. Special
education teachers cited the following as their sources of knowledge related to assistive
technology: workshops, articles, learning through trial and error, being provided with assistive
technology devices by the central office, occupational therapists, research, collaboration with
other teachers, other special education teachers, training by the Assistive Technology Specialist
from the central office, catalogs, coursework, professional development, and conferences. Thus,
according to the survey responses, the sources of knowledge for both teacher groups are very
similar. However, only the special education teachers specifically mentioned being trained by
the district’s Assistive Technology Specialist. Also, general education teachers frequently cited
their school’s special education teacher as a source of their knowledge regarding the specific
assistive technology devices featured on the survey.

The focus groups painted a slightly different picture of how general and special education
teachers attain knowledge of assistive technology. Multiple times during the focus groups, the
general education teachers maintained that they had never received any formal training regarding
the use of assistive technology devices, which was in contrast with the survey responses by
general education teachers that referred to professional development. The district’s Assistive
Technology Specialist was mentioned during the focus groups; however, only the special education teachers referenced this person as having provided training related to the implementation of assistive technology. Both teacher groups referred to independent research and online resources such as YouTube for learning about assistive technology. Only one special education teacher referred to her college coursework in relation to her assistive technology knowledge base.

Based on the data collected related to teachers’ sources of knowledge related to assistive technology, the source of knowledge most aligned with Shulman’s (2004) sources of the teacher knowledge base appears to be the “wisdom of practice.” There were few references to formalized education and scholarship. As previously suggested by from the findings of a study by Michaels and McDermott (2009), teacher preparation programs greatly differ in the integration of assistive technology knowledge and skills in coursework and field experiences. Instead, knowledge of assistive technology is knowledge that teachers may often acquire through what several teachers referred to during the focus groups and in open-ended survey items as “trial and error.” Many teachers conduct their own research and delve into articles pertinent to the needs of their students, although this does not necessarily entail “the scholarly literature base related to schooling, teaching, and learning” (Shulman, 2004). Instead, teachers are looking for that which is practical and often seek out practitioner-based resources such as “how to” videos on YouTube. Of great importance to the sources of teacher knowledge for assistive technology is that both general and special education teachers are collaborating and serving as a “useful source of knowledge for other practitioners” (Shulman, 2002, p. 232).
Research Question 4

The fourth research question was, what is the nature of this knowledge? Open-ended survey responses and the focus groups provided data related to this research question. The open-ended survey items and the focus group transcriptions were coded through the lens of Shulman’s (1986, 1987) concept of pedagogical content knowledge in order to explore and describe the nature of teacher knowledge related to assistive technology.

Teacher knowledge of assistive technology, as evidenced by the data collected during this study, is very specialized and may be likened to pedagogical content knowledge (Shulman, 1986). The knowledge needed by teachers to effectively select and implement assistive technology goes far beyond basic content knowledge and generic pedagogical knowledge (Shulman, 2004). Both teacher groups are selecting and implementing assistive technology devices for students who simply cannot access and master the content in the ways their general education counterparts can, whether due to visual and hearing impairments, fine motor skill deficiencies, learning disabilities, Autism, or any other exceptionality. Thus, instead of using a one-size-fits-all approach to teaching and learning, elementary general and special education teachers are using assistive technology as a means to “support the learning of their students” (Ball, Thames, & Phelps, 2008, p. 395). As one general education teacher described, the needs of students in inclusive classrooms “are getting more and more differentiated” and the need for “a plan for every one of your kids.” Thus, simply knowing the content and one way to teach a skill will not suffice in an inclusive classroom of diverse learners. One general education teacher described the need for “more training on different kinds of strategies just to meet different needs.” A “special amalgam of content and pedagogy” (Shulman, 1987, p. 8) that includes a
comprehensive knowledge of students and appropriate assistive technology resources and strategies is essential for meeting the needs of diverse learners in a general education setting.

**Overarching Research Question**

The overarching research question for this study was: How does the assistive technology knowledge of elementary general education teachers in inclusive classrooms compare to the assistive technology knowledge of elementary special education teachers? As suggested by the \( t \)-test, there is a significant difference in the assistive technology knowledge of elementary general education teachers and elementary special education teachers. The mean of the familiarity of each assistive technology device was higher for the elementary special education teachers than the elementary general education teachers. These data support the notion that elementary special education teachers have a more thorough knowledge of assistive technology than their general education counterparts. However, a \( t \)-test indicated no significant difference in the perception of value of assistive technology between elementary general and special education teachers. Thus, while elementary special education teachers may be more knowledgeable regarding specific assistive technology devices, both teacher groups perceive that assistive technology can be a valuable tool for assisting the learning process of students with special needs.

The data suggests that elementary special education teachers are receiving more training than elementary general education teachers. While open-ended survey items completed by both teacher groups referred to professional development, only special education teachers discussed professional development and training by the district’s Assistive Technology Specialist during the focus group sessions. Therefore, while some general education teachers may have acquired knowledge related to assistive technology via professional development, the focus group data
support the notion that elementary special education teachers are more likely to receive in-district professional development related assistive technology.

Collaboration between general and special education teachers, among general education teacher colleagues, and among special education teacher colleagues appears to be a prevalent practice for selecting and implementing assistive technology devices. General education teachers involved in the study discussed going to other general education teachers who had related experiences or who previously had particular students with special needs to inquire about strategies that worked for those students. Additionally, the general education teachers also referred to seeking guidance from special education teachers who then provided them with resources based on the needs of the students. Thus, the general education teachers appear to look to the special education teachers as a source of knowledge for meeting the needs of their students in their inclusive classrooms.

Yet, there may be breakdowns in collaborative practices and communication between the two teacher groups in regard to assistive technology. One general education teacher described being told by the special education teacher not to use a particular form of assistive technology with one of her students. The general education teacher was not provided with a rationale. Perhaps the special education teacher had a valid reason, based on her knowledge of the student and the assistive technology, for asking the general education teacher to discontinue the use of the assistive technology. However, this reason was unknown to the general education teacher, and she clearly felt frustrated that she had attempted to research and implement assistive technology to meet the needs of a struggling student and was not provided with a rationale for terminating the use of the technology. There appears to be a lack of a shared vision between the some of the general and special education teachers, which McClaren, Bausch, and Ault (2007)
previously identified as a barrier to collaborative efforts related to the effective selection and implementation of assistive technology.

Likewise, although special education teachers indicated the ways in which they involve general education teachers in the development of IEPs, such as through daily collaboration and teacher input surveys, general education teachers suggested they were not a part of the development of the assistive technology portion or any other component of the IEPs. Thus, general education teachers may not realize that special education teachers are using their daily interactions and conversations as a foundation for selecting assistive technology devices and services. There may also be instances where some special education teachers are not seeking input from general education teachers.

Furthermore, the focus group data found that not all assistive technology is documented on the IEP. Therefore, while a special education teacher has the knowledge of what assistive technology has been implemented for a particular student, when the student goes to the next grade level, the general education teacher may not necessarily be aware of the assistive technology devices that have been implemented. When this was discussed during the focus groups, the general education teachers were adamant that having this undocumented knowledge would be very beneficial when trying to meet the needs of diverse learners. This is another justification for ample collaboration and communication between general and special education teachers in regard to assistive technology.

Implications

The findings from this study have several implications for school districts, elementary general and special education teachers, and collegiate teacher preparation programs. First, assistive technology often allows learners with special needs to be able to access to the content
and curriculum in a general education classroom. Thus, if teachers are going to effectively select and implement assistive technology, they need an appropriate knowledge base for doing so. As suggested by the data from this study, elementary special education teachers appear to have a more comprehensive knowledge base regarding assistive technology compared to elementary general education teachers. Yet, with the increase in inclusive classrooms, general education teachers are the ones spending the majority of their day serving the students with special needs in their general education classrooms. The elementary general education teachers who participated in the focus groups cited the need for more knowledge as a necessity for effectively implementing assistive technology. General education teachers and special education teachers discussed finding their own knowledge through independent research and online resources. However, school systems can help these teachers by making sure that general education teachers are also receiving training related to assistive technology and inclusion. The school system in which this study took place does have an Assistive Technology Specialist. School districts that employ a specialist should take advantage of the specialist’s knowledge base and make sure that appropriate training is provided to all relevant personnel. This will help equip all teachers with the knowledge, skills, and strategies necessary for meeting the needs of diverse learners across a variety of educational settings.

A pertinent implication for general and special education teachers is that comprehensive documentation and thorough communication are essential to effective assistive technology integration in inclusive settings. Some of the special education teachers involved in this study suggested that for practical and financial reasons, every single form of assistive technology is not always documented on a student’s IEP. However, general education teachers asserted that any documentation of the assistive technology devices that have been previously implemented with
students in the past would be greatly beneficial in their quest to find effective strategies to meet the needs of diverse learners in a timely manner. Thus, as suggested by some of the teachers in one of the focus groups, an informal, general student profile sheet that could be passed to the next year’s teacher may be helpful for providing such documentation. This releases the school from being financially responsible for providing assistive technology but also provides a teacher with a snapshot of what has been effectively implemented with students during the previous year so that students’ subsequent teachers may continue to successfully meet their diverse needs. Collaborative dialogue can also aid in keeping both general and special education teachers informed of how students with special needs are progressing in inclusive classrooms and what assistive technology devices and strategies may be beneficial to their success. Due to the necessity of collaboration for effectively selecting and implementing assistive technology, there are implications for school leadership. Administrators need to assert the importance of these collaborative relationships and ensure that ample time is designated for effective collaboration to occur.

General and special education teachers may also consider being more collaborative with related service providers, such as occupational and physical therapists. These related service providers were often cited in the discussions of how assistive technology is selected and implemented. Since these professionals appear to have the knowledge necessary to choose and incorporate assistive technology, general and special education teachers may consult these related service providers when seeking to find assistive technology devices that might benefit students with certain disabilities.

Additionally, there was very little discussion during the focus groups related to how coursework in teacher education programs prepared both teacher groups to select and implement
assistive technology. Only one special education teacher mentioned her coursework during the focus groups, and none of the general education teachers referred to coursework during the focus groups. Typically, students majoring in elementary education are only required to complete one special education course during their undergraduate teacher education programs, and the course provided a broad overview of the field of special education but includes no practical experiences. Therefore, teacher preparation programs need to reevaluate their curricula related to the preparation of elementary general and special education teachers for meeting the needs of diverse learners in inclusive settings. Ensuring that both elementary general and special education teachers had ample coursework and practical experiences related to working with students with special needs in inclusive settings would help prepare both teacher populations to meet the needs of all learners. Furthermore, a review of the Alabama State Department of Education Administrative Code may be necessary to increase the rigor for teacher education programs in regard to preparing practitioners for working in inclusive settings, which would include effectively selecting and implementing assistive technology.

Limitations

This study does have several limitations. First, the study was limited to one school system. Since the study took place in one school district, there were far fewer special education teachers as participants compared to the number of general education teacher participants. This is due to the fact that there are often only one to two collaborative special education teachers per school. If the study was expanded to include multiple systems, the research may have yielded different or more generalizable results.

Additionally, due to scheduling and the willingness of survey participants to participate in the focus groups, not all schools within the school system were represented. Only four
participants were able to participate in the focus group with special education teachers due to the number of teachers who indicated on the survey that they would be willing to participate in focus groups. Despite these limitations, the researcher sought to ensure that a variety of teachers with a variety of years of experience were represented through both the survey and the focus groups in order to ensure as much reliability, validity, and generalizability as possible.

Another potential limitation is that the researcher was conducting research in her own school system. This could have influenced responses from some study participants based on their relationship with the researcher. In order to maintain an awareness of her potential influence and any bias during the research process, the researcher maintained a reflective journal over the course of the study.

**Recommendations for Future Research**

Based on the findings from this study, numerous research opportunities exist for expanding the research base within the field of assistive technology and inclusive elementary school classrooms. Suggestions for future research include the following:

1. The data generated from this study were limited to one school district. Many of the teachers who participated in the focus groups, particularly the general education teachers, indicated that they had received no formal training on assistive technology devices. Conducting a similar study across other school districts would provide insight as to whether any training opportunities are being provided for elementary general education teachers and elementary special education teachers in regard to utilizing assistive technology in inclusive classrooms;
2. This study only included elementary general and special education teachers. During open-ended survey items and focus groups, there were multiple references to related service providers, particularly OT (occupational therapists) and PT (physical therapists). A similar study could be conducted to see how collaboration with related service providers influences elementary general and special education teachers’ knowledge of assistive technology as well as the implementation of assistive technology;

3. During the focus groups, several of the general education teachers mentioned being overwhelmed by the range of ability levels within their classrooms. Research could be conducted to ascertain what pre-service and in-service opportunities are being provided to prepare general education teachers to work with students with special needs in inclusive classrooms;

4. During the focus groups, elementary general education teachers were asked about the ways in which they participated in the development of the assistive technology portion of IEPs. This teacher group indicated that they did not feel involved in the development of any portion of the IEPs. However, during the focus group with elementary special education teachers, this teacher group discussed daily collaboration with general education teachers and teacher input surveys as ways they involved general education teachers in the development of IEPs. Additional research could be undertaken to explore how collaborative practices drive inclusive education, including the development of IEPs for students in inclusive classrooms;
5. During open-ended survey items and focus groups, there were multiple references to students with Autism and visual and hearing impairments. Future studies could be conducted to explore the ways in which assistive technology devices are implemented in order to best serve students with specific exceptionalities in inclusive classrooms; and

6. Due to the lack of participants mentioning how their collegiate experiences prepared them with knowledge related to assistive technology, research may be done to ascertain the ways in which teacher preparation programs are or are not preparing both general and special education teachers to meet the needs of diverse learners in inclusive classrooms.

**Conclusion**

Assistive technology is mandated by the Individuals with Disabilities Education Improvement Act (IDEIA) of 2004. According to the IDEIA, assistive technology must be considered by the Individualized Education Plan team when creating IEPs. The IDEIA also calls for general education teachers to be involved in the IEP process. An increasing number of students with special needs spend the majority of their school days in an inclusive, general education classroom. Thus, more general education teachers are charged with educating students requiring special education services within their general education classrooms (Howell, 1996). According to the general education teachers involved in the focus groups, the students’ needs are “getting more and more differentiated” and teachers “need more training on different kinds of strategies just to meet different needs.”

Assistive technology is one way to make the general education curriculum accessible to students with special needs within an inclusive classroom. If general education teachers are to
contribute to IEPs in terms of suggestions for appropriate interventions, supplements, and modifications, and effectively implement assistive technology into their classrooms, these teachers need an appropriate knowledge base and skillset. However, the results from this study indicated a significant difference in the assistive technology knowledge of elementary general education teachers and elementary special education teachers. As general and special education teachers collaboratively share the responsibility for the education of students with special needs, it is essential that both teacher groups are equipped with the necessary pedagogical content knowledge to effectively choose and implement assistive technology devices and services to meet the needs of diverse learners in inclusive classrooms so that all students may be successful.
REFERENCES


APPENDIX A

IRB APPROVAL
February 25, 2013

Laura Knighton
Department of Curriculum & Instruction
College of Education
The University of Alabama

Re: IRB # EX-12-CM-072 (Revision) “Teacher Knowledge of Assistive Technology for Inclusive Classrooms”

Dear Ms. Knighton:

The University of Alabama Institutional Review Board has reviewed the revision to your previously approved exempt protocol. The board has determined that the change does not affect the exempt status of your protocol.

Please remember that your approval period expires one year from the date of your original approval, November 2, 2012, not the date of this revision approval.

Should you need to submit any further correspondence regarding this proposal, please include the assigned IRB application number. Changes in this study cannot be initiated without IRB approval, except when necessary to eliminate apparent immediate hazards to participants.

Good luck with your research.

Sincerely,

[Signature]

Carpus T. Myles, MSM, CIRM
Director of Research Compliance & Research Compliance Officer
Office of Research Compliance
The University of Alabama
APPENDIX B

ONLINE SURVEY
Assistive Technology

1. Demographic Data

Please complete the following demographic items.

**1. Please select your age range.**

- 20 - 29 years old
- 30 - 39 years old
- 40 - 49 years old
- 50 - 59 years old
- 60 or older

**2. Please select your years of teaching experience (including the current school year).**

- 1 - 5 years
- 6 - 10 years
- 11 - 15 years
- 16 - 20 years
- 21 - 25 years
- 26 or more years

**3. Which teaching certificate(s) do you have? (Check all that apply.):**

- Early Childhood Education
- Elementary Education
- Collaborative Special Education (K-6)
- Other (please specify)

**4. What is your current teaching assignment?**

- General Elementary Teacher
- Elementary Special Education Teacher
2. Assistive Technology: Specialized Calculators

*1. Please rate your familiarity with specialized calculators (such as talking calculators, those with large keys and displays, etc.).
   - [ ] No Familiarity
   - [ ] Familiar With
   - [ ] Implemented
   - [ ] Expert User

*2. Please rate the utility/value of using specialized calculators (such as talking calculators, those with large keys and displays, etc.).
   - [ ] Worthless
   - [ ] Somewhat Valuable
   - [ ] Extremely Valuable

3. If applicable, please describe how you have implemented specialized calculators in your classroom.

   

4. If applicable, please describe how you gained knowledge related to specialized calculators.

   


**1. Please rate your familiarity with pencils with adaptive grips.**

○ No Familiarity
○ Familiar With
○ Implemented
○ Expert User

**2. Please rate the utility/value of using pencils with adaptive grips.**

○ Worthless
○ Somewhat Valuable
○ Extremely Valuable

3. If applicable, please describe how you have implemented pencils with adaptive grips in your classroom.

4. If applicable, please describe how you gained knowledge related to pencils with adaptive grips.
**Assistive Technology**

4.

*1. Please rate your familiarity with adaptive keyboards (such as IntelliKeys, Big Keys, Discover Board, TASH, etc.).*

- No Familiarity
- Familiar With
- Implemented
- Expert User

*2. Please rate the utility/value of using adaptive keyboards (such as IntelliKeys, Big Keys, Discover Board, TASH, etc.).*

- Worthless
- Somewhat Valuable
- Extremely Valuable

3. If applicable, please describe how you have implemented adaptive keyboards (such as IntelliKeys, Big Keys, Discover Board, TASH, etc.) in your classroom.

4. If applicable, please describe how you gained knowledge related to adaptive keyboards (such as IntelliKeys, Big Keys, Discover Board, TASH, etc.).
### Assistive Technology

**5.**

1. Please rate your familiarity with reading rulers (such as an EZ Reader).
   - [ ] No Familiarity
   - [ ] Familiar With
   - [ ] Implemented
   - [ ] Expert User

2. Please rate the utility/value of using reading rulers (such as an EZ Reader).
   - [ ] Worthless
   - [ ] Somewhat Valuable
   - [ ] Extremely Valuable

3. If applicable, please describe how you have implemented reading rulers (such as an EZ Reader) in your classroom.

4. If applicable, please describe how you gained knowledge related to reading rulers (such as an EZ Reader).
Assistive Technology

6.

1. Please rate your familiarity with talking word processors (such as IntelliTalk, Write: Out Loud, Dragon Speech Recognition Software, etc.).

- No Familiarity
- Familiar With
- Implemented
- Expert User

2. Please rate the utility/value of using talking word processors (such as IntelliTalk, Write: Out Loud, Dragon Speech Recognition Software, etc.).

- Worthless
- Somewhat Valuable
- Extremely Valuable

3. If applicable, please describe how you have implemented talking word processors (such as IntelliTalk, Write: Out Loud, Dragon Speech Recognition Software, etc.) in your classroom.

4. If applicable, please describe how you gained knowledge related to talking word processors (such as IntelliTalk, Write: Out Loud, Dragon Speech Recognition Software, etc.).
1. Please rate your familiarity with adapted seating (such as Rifton chairs, gel cushions and pads, etc.).
   - No Familiarity
   - Familiar With
   - Implemented
   - Expert User

2. Please rate the utility/value of using adapted seating (such as Rifton chairs, gel cushions and pads, etc.).
   - Worthless
   - Somewhat Valuable
   - Extremely Valuable

3. If applicable, please describe how you have implemented adapted seating (such as Rifton chairs, gel cushions and pads, etc.) in your classroom.

4. If applicable, please describe how you gained knowledge related to adapted seating (such as Rifton chairs, gel cushions and pads, etc.).
Assistive Technology

8.

*1. Please rate your familiarity with software for students to use to organize their ideas (such as Kidspiration, Inspiration, PowerPoint, etc.).
   - No Familiarity
   - Familiar With
   - Implemented
   - Expert User

*2. Please rate the utility/value of using software for students to use to organize their ideas (such as Kidspiration, Inspiration, PowerPoint, etc.).
   - Worthless
   - Somewhat Valuable
   - Extremely Valuable

3. If applicable, please describe how you have implemented software for students to use to organize their ideas (such as Kidspiration, Inspiration, PowerPoint, etc.) in your classroom.

4. If applicable, please describe how you gained knowledge related to software for students to use to organize their ideas (such as Kidspiration, Inspiration, PowerPoint, etc.).
**1. Please rate your familiarity with math manipulatives, including an abacus or Math Line, counters, and a number line.**
- ○ No Familiarity
- ○ Familiar With
- ○ Implemented
- ○ Expert User

**2. Please rate the utility/value of using math manipulatives, including an abacus or Math Line, counters, and a number line.**
- ○ Worthless
- ○ Somewhat Valuable
- ○ Extremely Valuable

3. If applicable, please describe how you have implemented math manipulatives, including an abacus or Math Line, counters, and a number line in your classroom.

4. If applicable, please describe how you gained knowledge related to math manipulatives, including an abacus or Math Line, counters, and a number line.
**Assistive Technology**

10.

**1. Please rate your familiarity with talking books (such as books on tape/CD and electronic books).**
- [ ] No Familiarity
- [ ] Familiar With
- [ ] Implemented
- [ ] Expert User

**2. Please rate the utility/value of using talking books (such as books on tape/CD and electronic books).**
- [ ] Worthless
- [ ] Somewhat Valuable
- [ ] Extremely Valuable

3. If applicable, please describe how you have implemented talking books (such as books on tape/CD and electronic books) in your classroom.

4. If applicable, please describe how you gained knowledge related to talking books (such as books on tape/CD and electronic books).
**Assistive Technology**

**11.**

*1. Please rate your familiarity with visual schedules, calendars, and lists.*

- [ ] No Familiarity
- [ ] Familiar With
- [ ] Implemented
- [ ] Expert User

*2. Please rate the utility/value of using visual schedules, calendars, and lists.*

- [ ] Worthless
- [ ] Somewhat Valuable
- [ ] Extremely Valuable

3. If applicable, please describe how you have implemented visual schedules, calendars, and lists in your classroom.

4. If applicable, please describe how you gained knowledge related to visual schedules, calendars, and lists.
Thank you for taking the time to complete this survey! The researcher will be collecting additional data related to this study through face-to-face focus groups. These focus groups will be held during the afternoon, following regular school hours. If you would be willing to participate in a focus group, please complete the information below. Focus group participants will receive a $10 Starbucks gift card for their participation.

1. Please enter your name, e-mail address, and telephone number if you are willing to participate in a focus group related to this study.

<table>
<thead>
<tr>
<th>Name:</th>
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<td>Email Address:</td>
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<tr>
<td>Phone Number:</td>
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</table>
Dear Fellow Teacher,

I respectfully request your participation in a research study I am conducting for my doctoral dissertation through The University of Alabama, College of Education: Educational Leadership, Policy, and Technology Studies. The goal of this research study is to learn more about elementary general and special education teachers’ knowledge related to assistive technology in inclusive classrooms. You were selected as a potential participant in this study because of your status as an elementary general or special educator. Your participation in this study is voluntary. I do appreciate your consideration of participation in this study. A statement of informed consent is attached to this e-mail for your records.

If you decide to participate, you will complete an online survey comprised of 40 items. The survey should take approximately twenty minutes to complete. Demographics to be collected during the survey include age, teaching certification area(s), current teaching assignment, and years of experience. Your responses will be kept secured and confidential. If you agree to participate in this survey, please click the following link to access the survey:

Please do not hesitate to contact me if you have any questions or concerns.

Sincerely,

Laura Knighton
APPENDIX D

SURVEY RECRUITMENT FOLLOW UP E-MAIL
Dear Fellow Teacher,

This message is a follow up to the previous e-mail that I sent regarding your potential participation in a survey I am conducting for my doctoral dissertation through The University of Alabama, College of Education: Educational Leadership, Policy, and Technology Studies. The goal of this research study is to learn more about elementary general and special education teachers’ knowledge related to assistive technology in inclusive classrooms. You were selected as a potential participant in this study because of your status as an elementary general or special educator. Your participation in this study is voluntary. I do appreciate your consideration of participation in this study. A statement of informed consent is attached to this e-mail for your records.

If you decide to participate, you will complete an online survey comprised of 40 items. The survey should take approximately twenty minutes to complete. Demographics to be collected during the survey include age, teaching certification area(s), current teaching assignment, and years of experience. Your responses will be kept secured and confidential. If you agree to participate in this survey, please click the following link to access the survey:

I respectfully request that you consider completing this survey. My study will only be credible and effective if I have ample participation from elementary general and special education teachers. Thank you for your consideration of this request.

Please do not hesitate to contact me if you have any questions or concerns.

Sincerely,

Laura Knighton
APPENDIX E

INFORMED CONSENT FORM FOR SURVEY PARTICIPANTS
INFORMED CONSENT STATEMENT (Survey)

Teacher Knowledge of Assistive Technology for Inclusive Classrooms

Dear Potential Participant:

You are invited to participate in a research study conducted by Laura Knighton, from The University of Alabama, College of Education: Educational Leadership, Policy, and Technology Studies. Ms. Knighton is a graduate study at The University of Alabama and is being supervised by Dr. Vivian Wright, a professor of Curriculum and Instruction at The University of Alabama. The goal of this research study is to learn more about elementary general and special education teachers’ knowledge related to assistive technology in inclusive classrooms. You were selected as a possible participant in this study because of your status as an elementary general or special educator. Approximately 200 participants are being recruited from ________________ Schools for this study.

If you decide to participate, you will complete an online survey comprised of 40 items. The survey should take approximately twenty minutes to complete. Demographics to be collected during the survey include age, teaching certification area(s), current teaching assignment, and years of experience.

There are no known risks or discomforts associated with your participation in this study. This study will contribute to the research by exploring how the assistive technology knowledge of general educators compares to that of special educators and how these two teacher groups make decisions related to assistive technology in inclusive classrooms. However, I cannot guarantee that you personally will receive any benefits from this research. There will be no compensation or incentive for your participation in this study.

Survey responses and participants’ identities will be kept strictly confidential. Demographic information will be collected during the survey; however, you will not be personally identified by any of the information you provide. The survey will be kept in a secure, locked location. The information you provide will not be provided to anyone else other than through the reporting of the analysis of the data. Data will be reported collectively and based on group demographics.

Your participation is voluntary. Your decision whether or not to participate will not affect your relationship with your school, school district, or The University of Alabama. If you decide to participate, you are free to withdraw your consent and discontinue participation at any time without penalty.

If you have any questions, please feel free to contact Laura Knighton at (256) 282-3296 or by e-mail at hembr005@crimson.ua.edu. You may also contact Dr. Vivian Wright, The University of Alabama Associate Professor at (205) 348-1401. If you have any questions, concerns, or complaints about your rights as a participant, you may contact Ms. Tanta Myles, The University of Alabama Research Compliance Officer, at 205-348-8461, or toll free 877-820-3066.
Completing the questionnaire/survey constitutes your consent to participate and certifies that you are 19 years of age [19 is legal age of consent in Alabama] or older. Please keep this letter for your records.

You may also ask questions, makes suggestions, or file complaints and concerns through the IRB Outreach website at http://osp.ua.edu/site/PRCO_Welcome.html or e-mail us at participantoutreach@bama.ua.edu. After you participate, you are encouraged to complete the survey for research participants that is online at the outreach website, or you may ask the investigator for a copy of it and mail it to the University Office of Research Compliance, Box 870127, 358 Rose Administration Building, Tuscaloosa, AL 35487-0127.
APPENDIX F

FOCUS GROUP QUESTIONS FOR ELEMENTARY GENERAL EDUCATION TEACHERS
Questions for Focus Group with Elementary General Education Teachers:

1. How do you make decisions related to when to use assistive technology with special needs students in your classroom?

2. How do you make decisions related to how to use assistive technology with special needs students in your classroom?

3. How do you acquire assistive technology tools and strategies for meeting the needs of diverse learners?

4. What has been your experience as a participant in the development of the assistive technology portion of IEPs for students with special needs?

5. Based on the survey, what are your overall opinions on the utility of assistive technology?

6. Are there any devices on the survey which you have found to be particularly effective? If so, please elaborate.

7. Have you received any training or professional development or professional development on assistive technology? If so, please describe the experience.

8. Where and how have you acquired the knowledge related to assistive technology devices?
APPENDIX G

FOCUS GROUP QUESTIONS FOR ELEMENTARY GENERAL AND SPECIAL EDUCATION TEACHERS
Questions for Focus Group with Elementary General and Special Education Teachers:

1. How do you make decisions related to the selection and implementation of assistive technology?

2. How do you work together as general and special education teachers to make assistive technology decisions in order to meet the needs of your students with special needs?

3. What types of assistive technology have you implemented?

4. What successes have you had in using assistive technology?

5. What barriers do you have with selecting and implementing assistive technology?

6. What are your thoughts on the value of assistive technology?

7. What are your needs in order to utilize assistive technology more effectively?
APPENDIX H

FOCUS GROUP QUESTIONS FOR ELEMENTARY SPECIAL EDUCATION TEACHERS
Questions for Focus Group with Elementary Special Education Teachers:

1. How do you ensure that students with special needs on your caseload are receiving the assistive technology devices and services as outlined within their IEPs?

2. Describe how you acquire assistive technology tools and strategies for meeting the needs of diverse learners.

3. In what ways do you include general education teachers in the development of the assistive technology portion of IEPs?

4. What are your opinions on the utility of assistive technology?

5. Are there any devices on the survey which you have found to be particularly effective? If so, please elaborate.

6. How do you make assistive technology decisions for students’ IEPs?

7. After assistive technology is selected, what procedures do you use for implementing the technology?
INFORMED CONSENT FORM (Focus Group)

Teacher Knowledge of Assistive Technology for Inclusive Classrooms

Dear Potential Participant:

You are invited to participate in a research study conducted by Laura Knighton, from The University of Alabama, College of Education: Educational Leadership, Policy, and Technology Studies. Ms. Knighton is a graduate study at The University of Alabama and is being supervised by Dr. Vivian Wright, a professor of Curriculum and Instruction at The University of Alabama. The goal of this research study is to learn more about elementary general and special education teachers’ knowledge related to assistive technology in inclusive classrooms. You were selected as a possible participant in this study because of your status as an elementary general or special educator. Approximately 200 participants are being recruited from _________________ Schools for this study.

If you decide to participate, you will participate in a face-to-face focus group. The focus group will last approximately one hour. The focus group session will be audio recorded and then transcribed by the researcher for the purpose of data analysis. All recordings and transcriptions will be kept confidential and stored in a secure location. At the end of the study, the recordings and transcriptions will be destroyed. You have the right to decline to be audio taped. However, as audio taping is necessary to secure a copy of the data for transcription and analysis, if you decline to be audio taped, you will not be able to participate in the focus group.

There are no known risks or discomforts associated with your participation in this study. This study will contribute to the research by exploring how the assistive technology knowledge of general educators compares to that of special educators and how these two teacher groups make decisions related to assistive technology in inclusive classrooms. However, I cannot guarantee that you personally will receive any benefits from this research. As an incentive for participating in the focus group portion of this study, you will receive a $10 gift card to Starbucks.

Responses and participants’ identities will be kept strictly confidential. Demographic information will be collected; however, you will not be personally identified by any of the information you provide. The data collected will be kept in a secure, locked location. The information you provide will not be provided to anyone else other than through the reporting of the analysis of the data. Data will be reported collectively and based on group demographics.

Your participation is voluntary. Your decision whether or not to participate will not affect your relationship with your school, school district, or The University of Alabama. If you decide to participate, you are free to withdraw your consent and discontinue participation at any time without penalty.

If you have any questions, please feel free to contact Laura Knighton at (256) 282-3296 or by e-mail at hembr005@crimson.ua.edu. You may also contact Dr. Vivian Wright, The University of Alabama Associate Professor at (205) 348-1401. If you have any questions, concerns, or
complaints about your rights as a participant, you may contact Ms. Tanta Myles, The University of Alabama Research Compliance Officer, at 205-348-8461, or toll free 877-820-3066.

Participating in the focus group constitutes your consent to participate and certifies that you are 19 years of age [19 is legal age of consent in Alabama] or older. Please keep the copy of this letter for your records.

You may also ask questions, makes suggestions, or file complaints and concerns through the IRB Outreach website at http://osp.ua.edu/site/PRCO_Welcome.html or e-mail us at participantoutreach@bama.ua.edu. After you participate, you are encouraged to complete the survey for research participants that is online at the outreach website, or you may ask the investigator for a copy of it and mail it to the University Office of Research Compliance, Box 870127, 358 Rose Administration Building, Tuscaloosa, AL 35487-0127.

_____ You have my permission to audio record my participation in the focus group.

_____ I decline to be audio taped during the focus group. Therefore, I will be unable to participate in the focus group.

__________________________________________ __________
Participant’s signature      Date

__________________________________________ __________
Researcher’s signature     Date