ASSISTIVE TECHNOLOGY EVALUATION EXPERTISE WHEN MATCHING HIGH-TECHNOLOGY DEVICES TO STUDENTS IDENTIFIED WITH SPECIFIC LEARNING DISABILITIES

A DISSERTATION

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

IN THE GRADUATE SCHOOL OF THE

TEXAS WOMAN'S UNIVERSITY

DEPARTMENT OF TEACHER EDUCATION

COLLEGE OF PROFESSIONAL EDUCATION

BY

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DENTON, TEXAS

DECEMBER 2013

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DEDICATION

For my children, Nicholas, Katherine, Claire, and Christopher Scrofano.
Thank you for taking this journey with me from beginning to end.

ACKNOWLEDGEMENTS

I gratefully acknowledge all the individuals who contributed to the completion of this dissertation. First and foremost, I am grateful to God. The sacrifices to get through the doctoral program have been the sum of decisions that were in God's hands, and I would not have completed this program without that faith. I would like to thank my committee chair, Dr. Jane Pemberton, and co-chair, Dr. Heather Haynes, for their guidance and encouragement. I am appreciative to the members of my dissertation committee, Dr. Michael Wiebe and Dr. David Marshall. Dr. Marshall's support was inspiring and uplifting, and I truly appreciate his candor. I would also like thank the department faculty for fostering my growth as a researcher. Finally, I would like to thank my family for their unwavering support and love. I especially thank Nicholas, Katherine, Claire, and Christopher Scrofano for being with me through the doctoral program since the beginning. I cannot express how proud I am of them and I am blessed to be their mother. I would also like thank Cameron, Anna, and Matthew Sousa, my stepchildren, who have never known me not hovered over a computer typing. I also thank my mother, Ann Marie Thompson, my best friend, and my stepfather, Walter Dutton. Thanks also go to my dad, Michael Thompson and stepmother Esther Thompson. To my husband, Marc Sousa, I thank for his support in every way. He made this process bearable with his love, patience, and willingness to help.

ABSTRACT

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ASSISTIVE TECHNOLOGY EVALUATION EXPERTISE WHEN MATCHING HIGH-TECHNOLOGY DEVICES TO STUDENTS IDENTIFIED WITH SPECIFIC LEARNING DISABILITIES

DECEMBER 2013

Rates of use associated with assistive technology by individuals with specific learning disabilities were compared to rates associated with low incidence disabilities. To address disproportionate practices for specific learning disabilities, four constructs (combined dependent variables) were created: (1) knowledge of specific learning disabilities, (2) knowledge of computerized devices, (3) expertise in assessment for computerized assistive technology devices with specific learning disabilities, and (4) frequency of consideration. Based on the constructs, a survey was piloted and distributed online to professionals involved with assistive technology decisions. Participants were separated into four groups typically found in IEP meetings: (1) related service providers (2) special education specialists, (3) general education instructional specialists (4) education technology specialists. The level of self-reported knowledge, expertise, and frequency were analyzed and described by comparing the groups. A fifth independent variable, collaboration, was created and compared among the constructs using ANOVA and significant findings were found regarding level of collaboration in relation to the four

constructs associated with assessment of computerized assistive technology when paired with specific learning disabilities.

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CHAPTER I

INTRODUCTION

Because of the interdisciplinary nature of assistive technology, this chapter describes a number of important concepts relating to the field of assistive technology as a whole. The focus of this chapter is Melichar's (1978) work on human functioning and special education technology. This chapter also describes the confluence of technology and educational performance and its influence on public policy regarding assistive technology including assistive technology evaluation practices. The chapter concludes with models of evaluation for assistive technology in education.

Assistive Technology

Assistive technology is an intervention used to compensate for disabilities related to human functioning, which can take the form of a service, a device, or both. An assistive technology device may be any item that assists an individual with functioning. Assistive technology devices range from low to high technology, and consideration for the use of a device is environment dependent. Devices may be as simple as a modified handle or as complex as adapted technology and software for accessible computers. Overall, assistive technology is defined in various ways. Depending on relevant public policy, a diagnosis of a disability does not guarantee that assistive technology will be provided.

The process of determining whether assistive technology is needed is dynamic and services related to the use of assistive technology include undergoing assessment, securing funding, facilitating procurement of a device, maintaining a device, or undergoing interventions that do not require a device. Assistive technology practitioners assist with services related to obtaining and using these devices. Thus, services vary depending on the agency providing those services.

The experience, certification, and licensing needed to become an assistive technology practitioner can be as diverse as the service provided. A variety of discipline specific professional organizations provide training for assistive technology practitioners. Assistive technology practitioners come from a variety of educational backgrounds depending on the disability they choose to serve (National Center for Education Statistics [NCES], 2012). Doctors, nurses, rehabilitation counselors, occupational, and physical therapists are a few professionals who can provide assistive technology services. Certified educators may also provide assistive technology services to students with disabilities in educational settings, often with the input from other professionals.

Model of Human Functioning

The field of assistive technology is based on Melichar's (1978) seminal work on human functioning. Melichar separated human functioning into seven domains that make up the basic components of human existence. Assistive technology practitioners use these domains as starting points for evaluation. The Melichar's seven domains are as follows:

- Existence: Functioning required for living (e.g., breathing and nutrition).

- Body Support: Functioning for positioning and support.
- Communication: Expressive and receptive language processes to express one's basic needs.
- Mobility: Movement from point A to point B.
- Adaptive: Functioning necessary for daily living skills.
- Education: Functioning within the context of the school environment includes transitioning.
- Recreation: Sports and leisure activities.

The existence domain concerns function that sustains life. Assistive technology devices that support eating, sleeping, and hygiene are examples of devices that address this area of human functioning. Communication involves receptive and expressive language as well as social functioning. Receptive language refers to information gathered by hearing or vision that is processed internally and affects social functioning. Mobility and body support include adaptive behaviors or daily living skills in this area that are frequently considered in special education. Finally, recreation refers to any leisure activity. In education, adaptive behaviors are those needed in the areas of transitioning. For students, adaptive behaviors generally refer to those required to function effectively in the school environment or assist with educational performance.

Technology in Special Education

Blackhurst (2005) suggested technology in special education takes six forms: technology of teaching, instructional technology, assistive technology, technology productivity tools, information technology, and medical technology. Of note, medical technology is not pertinent to the focus of the study, therefore, is not included in this discussion. In the field of special education, matching technology to education supports the educational performance component as defined by Melichar (1978). The following illustrates this matching of technology to education

- Technology of teaching: Direct instructional methods, discrete skills teaching.
- Instructional technology: Multimedia instructional tools.
- Assistive technology: Devices and services directed to individuals with disabilities.
- Technology productivity tools: Hardware and software to enhance productivity.
- Information technology: Internet and associated applications.

In addition to Blackhurst's (2005) definitions, Gersten and Edyburn (2007) included two other forms of technology, distance education (the use of remote learning via technology), and Universal Design for Learning (Rose & Meyer, 2002) (the use of technology to provide curricular access). To clarify these areas, Blackhurst (2005) and Gersten and Edyburn (2007) cited a number of technology areas cited that can be considered assistive technology depending on an individual's disability. For example, productivity tools, instructional technology, and technology of teaching assist the educational functioning of individuals with disabilities.

While assistive technology services and devices are often discussed together, Gersten and Edyburn (2007) point out that these tools and technologies should not be construed solely as a service or device, as the terms are not interchangeable.

Consideration of assistive technology is determinant on the individual and his or her functional needs. Because of the dynamic nature of assistive technologies, defining technology as assistive has been a source of frustration for researchers resulting in unclear operational definitions of the concept.

Educational Performance and Technology: Assistive Technology

This study is framed within the intersection of special education, assessment, instruction (Blackhurst, 2005; Melicar, 1978), and computerized educational technology. Over the past 2 decades, many researchers have been concerned with how special education services should be provided (Gerston, 2010). This focus shifted from broad programming, such as mainstreaming and inclusion for students with disabilities, to direct instruction in the 1990s. By 2000, research shifted focus back to response to intervention (RtI), Positive Behavior Supports (PBS), and universal design for learning (UDL) to address the needs of diverse learners, regardless of setting.

At the same time, delivery of services to general and special education students was evolving along with technology. The capabilities of computers increased and they became smaller, quicker, lighter, and easier to use. The Internet, social media, and mobile devices made computerized technology ubiquitous. In response to the knowledge base of digital natives (i.e., children who grew up in the digital age), classrooms began instituting learning platforms for multimedia instruction. With developments in education and technology, educators became increasingly focused on how technology could support diverse learners, particularly in inclusive settings. Thus, it became necessary to change public policy in education to address these rapid advances in technology.

Public Policy

Gerston (2010) reported society can alter cultural values and influence what the government is obliged to provide. Likewise, the way in which a disability is conceptualized dictates the model of and assumptions about that disability (Smart, 2011). Based on perceptions in instruction, service to individuals with disabilities, and technological breakthroughs, special considerations for assistive technology were incorporated into the reauthorization of Individuals with Disabilities Educational Improvement Act in 1990 (IDEIA, 1990).

The purpose of IDEIA is to provide students with disabilities services to ensure free and appropriate public education (FAPE). Specifically, IDEIA defined disabilities and the means for services and procedural safeguards to ensure such services would be provided. Compliance of IDEIA involves documentation in an individual's educational plan (IEP) which documents FAPE in the least restrictive environment (LRE).

To provide appropriate programming for students identified with disabilities, IDEIA mandates the consideration of assistive technology (IDEIA, 2004). The IDEIA requires assistive technology be considered; however, no guidance is given to state education agencies (SEA) concerning best practices or accepted consideration. Therefore, SEAs developed additional mandates to address compliance requirements for districts or local education agencies (LEA). However, these additional mandates offer no greater guidance in assistive technology evaluation. To address these gaps, professional assistive technology organizations have suggested best practices for evaluation when determining assistive technology for individuals with disabilities.

Statement of the Problem

Federal law mandates that assistive technology be considered for all disabilities. However, a disproportionate representation exists among disability groups and, in particular, when comparing low to high incidence disabilities. Low-incidence disabilities are severe educational disabilities that have a projected occurrence of 1% of the school-aged population at any given time (e.g., autism, sensory disabilities). High-incidence disabilities represent the majority of those served by special education.

Specific learning disabilities are considered high-incidence because they occur in 41% of the total student special education population (NCES, 2012). Nevertheless, the assistive technology use rate among this group is at about 16% (Quinn et al., 2009). In comparison, low-incidence disabilities have an assistive technology use rate of 54% (Quinn et al., 2009), and sensory disabilities have an anticipated use rate of 100% (Golden, 1998).

Broad issues in research quality and models of practice have influenced evaluation practices of assistive technology practitioners when serving students with educational disabilities (NCES, 2012). Based on these issues, it can be deduced that specific learning disabilities and consideration for computerized assistive technology are also affected. Examples of these issues include lack of generalizability due to problem-based assessment and poor operational definitions and replicable procedures in research.

Technological advancements in the early 21st Century have created the need to determine best professional practices when matching computerized assistive technology devices to students identified with specific learning disabilities (Woodward & Rieth, 1997). For example, IDEIA (2004) requires all students identified with a disability be considered for assistive technology. Evaluations for these students in public schools involve considering the potential need for assistive technology devices and services to ensure FAPE.

Federal law defines assistive technology services as those that directly assist in acquiring or assessing assistive technology devices (IDEIA, 2004). Assistive technology devices are defined as equipment, either acquired commercially or customized, that increases the functional capabilities of individuals with disabilities (IDEIA, 2004). These devices can be described as low tech (e.g., a pencil grip), medium tech (e.g., the use of a switch), or high tech (e.g., computerized devices or software and their applications).

States have significant latitude in the documentation of IDEIA compliance of assistive technology consideration (Bausch, Quinn, Chung, Ault, & Behrmann, 2009). The IDEIA requirements are limited to documentation of compliance and they do not provide professional guidance in the evaluation of assistive technology (Reed & Bowser, 2005). Therefore, the proposed study went beyond issues of compliance to examine assistive technology professionals' self-reported expertise when pairing computerized assistive technology devices with students identified with specific learning disabilities.

Purpose of the Study

The purpose of this study was to measure the self-efficacy and knowledge of assistive technology providers' evaluation practices when considering computerized assistive technology for students identified with specific learning disabilities. Specifically, variables were determined that influence the pairing of computerized assistive technology with individuals with specific learning disabilities. Variables include professional experience, collaboration, knowledge of computerized assistive technology, and knowledge of specific learning disabilities. As such, the following research questions guided this study:

1. What is the self-reported expertise of assistive technology practitioners in computerized assistive technology?
2. What is the expertise of assistive technology practitioners concerning specific learning disabilities?
3. What is the self-reported expertise of assistive technology practitioners when evaluating computerized assistive technology for students identified with specific learning disabilities?
4. Is there a difference in self-reported expertise between participants who collaborate versus those who do not when matching computerized assistive technology with students identified with specific learning disabilities?

Importance of the Study

The study described variables that could influence decisions when matching computerized assistive technology with individuals with specific learning disabilities. It was proposed that, because of the heterogeneity of computerized assistive technology devices and individuals with specific learning disabilities, outcomes are difficult to generalize. The self-reported expertise of assistive technology practitioners in computerized assistive technology with specific learning disabilities is reported. The study also answered the question of whether a difference exists in the self-reported expertise between participants who collaborate versus those who do not when matching computerized assistive technology with students identified with specific learning disabilities.

Definition of Terms

Because the study relied on recipients identified with disabilities in the school setting, operational definitions are provided in accordance with IDEIA (2004). In 1990, the IDEIA defined assistive technology as a school service that is considered for all students who qualify for special education services. Because the mandates of IDEIA (2004) are limited to documenting compliance, procedural areas, such as assessment, are shaped and defined by best practices suggested by professional assistive technology groups. The terms associated with assistive technology, specific learning disability, and assessment practices are presented below.

Assistive technology device: An assistive technology device is equipment, whether acquired commercially or customized, used to maintain or increase the functional capabilities of individuals with disabilities. These devices can be hardware or software, or stand alone (Assistive Technology Act [ATA], 1998). These devices do not include surgically implanted devices such as cochlear implants. Assistive technology can be explained as a continuum based on its technological complexity from low to medium to high. For example, a person with an expressive language delay may be assisted by a low-technology device (e.g., printed picture prompts) or a high-technology device (e.g., computerized assisted instruction).

Assistive technology evaluation: Assistive technology evaluation involves the dynamic process of consideration and assessment (National Assistive Technology Research Institute [NATRI], 2012). Evaluation involves consideration for the need of assistive technology and determination of the means to provide the student with access, to the greatest extent appropriate, to the general education curriculum. The evaluation begins with baseline to determine the student's present level of functioning, and then the determination of benefit from assistive technology is made. Once these factors are determined, further assistive technology evaluation occurs.

An assessment for assistive technology focuses on determining the goodness of fit of a device and its ability to provide access to FAPE. The evaluation must be conducted by a knowledgeable multidisciplinary team, and decision-making procedures should follow a functional framework (Reed, 2007; Quality Indicators of Assistive Technology, 2012).

Assistive technology practitioner: In the context of the public school system, an assistive technology practitioner is an educational professional who provides assistive technology services. For the purposes of this study, assistive technology practitioners are professionals who provide assessment or matching of assistive technology devices to students identified with specific learning disabilities. These professionals are not involved in device procurement or funding. In addition to assessment and matching, assistive technology practitioners conduct device trials for student outcomes. These professionals are from a variety of certifications and backgrounds and are grouped into four categories. Three of the professional groupings documented in the IEP are related service professionals, and general and special education. The fourth category is the computerized technology support professional.

Assistive technology outcomes: Once a device is determined, device trials, which take the form of a single-subject experiment, are implemented. Baseline performance and improvement are also tracked. The criterion for success of an assistive technology device or service is the level of functional improvement in response to environmental demands.

Assistive technology recipients: Recipients of assistive technology must demonstrate educational need related to an educational disability. Therefore, a medical disability does not automatically qualify a student as having an educational disability (IDEIA, 2004). Rather medical disabilities must be proven to restrict access to FAPE in the LRE. Once the criteria for an educational disability is met and an appropriate IEP is developed, then, a determination is made as to whether the student requires assistive technology based on the criteria of the IDEIA.

Assistive technology services: The IDEIA (2004) defines assistive technology services as those that directly assist children with disabilities in the selection, acquisition, or use of an assistive technology device. The five components of assistive technology service, as mandated by IDEIA, are evaluation, funding, training, coordination of services, and device matching and maintenance. Services are accomplished by completing any of these components, which depends on the needs of the student (IDEIA, 2004). This study focused on the evaluation component of assistive technology services.

Computerized assistive technology device: When high tech devices are required, computerized assistive technology devices and services are the focuses of evaluation. For the purposes of the study, inclusion criteria for a computerized assistive technology device are that it is either hardware or software. Further differentiation of hardware includes computer hardware and augmented input and output devices that support access. Computer hardware ranges from desktop computers to mobile devices or wireless receivers. For purposes of this study, software includes programs, applications, internet shareware, platforms, and multimedia. Other devices typically not considered for specific learning disabilities were excluded from the study. For example, computerized technology devices that are for mobility or sensory disabilities were excluded (e.g., a motorized wheelchair).

Specific learning disabilities: The study focused on the expertise of assistive technology practitioners when pairing computerized devices to assistive technology recipients who have been identified as having specific learning disabilities. Specific learning disabilities are not medical diagnoses; rather relate to educational factors, and are seen as patterns of strengths and weaknesses that affect academic performance. These disabilities can affect one or multiple academic or achievement areas. Theories on the etiology of specific learning disabilities vary, and may influence a school district's method of identification and service provision.

The IDEIA (2004) defines specific learning disabilities as poor academic achievement compared to the child's age or grade-level standards in one or more of the following areas: oral expression, listening comprehension, written expression, basic reading skills, reading fluency, reading comprehension, mathematics calculation, and math problem solving. Evidence must also exists that the learning disability is not the result of another educational disability, lack of educational opportunities, or cultural or linguistic factors.

Two models exist to identify of children with learning disabilities (Swanson, 2006). The problem-based model classifies the student based on a demonstrated behavior (i.e., poor academic performance). This model is devoid of theoretical assumptions and focuses on student achievement. The intra-individual differences model assesses students in terms of projected versus actual achievement. This type of assessment is complete using norm-referenced tests, as with a problem-based approach, but the focus is on determining the pattern of strengths and weaknesses and their affect on academic achievement.

The criteria for a specific learning disability are subjective. Additionally, learning disabilities are considered soft disabilities, which indicate that they are not easily quantified or observed. In comparison to sensory or physical disabilities, an evaluator must identify specific learning disabilities. A further contributor to the subjectivity of specific learning disabilities is that they are heterogeneous. The various levels and areas of impact of these disabilities and the various needs of students make the identification of a specific learning disabilities difficult and, in turn, challenging for assistive technology practitioners to determine appropriate services or devices.

Unique to specific learning disabilities is that computerized assistive technology devices can be used as *cognitive prostheses* (Edyburn, 2002). Similar to an individual with a physical or sensory disability who requires an assistive technology device for physical access, an individual with a specific learning disability may require a device for cognitive access.

CHAPTER II

REVIEW OF THE LITERATURE

The review of literature involved a number of steps including an electronic search using EBSCO, ERIC, and PsychData. Peer-reviewed articles, published from 1990 to 2013 were reviewed as were assistive technology professional websites and manuals. A manual search of the *Journal of Special Education Technology* and *Assistive Technology*, published by the Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) also was conducted.

The literature review focused on a number of aspects to provide the rationale for this study and used search criteria suggested by Gall, Borg, and Gall (1996) and Hart (1998). Specifically, the review of the literature was conducted to delimit the study and gain methodological insight on assistive technology evaluation research. The review of literature was also done to determine variables relevant to the study and identify relationships between research and practice. Additionally, quality indicators described by Boote and Beile (2005) were used to organize the literature review. This process resulted in five areas, four of which are discussed in this chapter, coverage, synthesis, methodology, and significance.

The coverage of the review of literature involved two steps as suggested by Cooper (1998). The first step included collecting a representative sample of research addressing issues associated with assistive technology assessment and disabilities. Because of the limited representation of research in this area, the second step involved a purposive sample to review of literature. The purposive sample used references pivotal in the field of assistive technology evaluation. Articles selected were based on current practices in assistive technology evaluation for individuals with disabilities in education. From these articles, inferences were made about assistive technology evaluation practices for disabilities in education and applied to evaluation practices for computerized assistive technology devices for specific learning disabilities.

The research conducted was a synthesis of the literature according to the criterion set by Boote and Beile (2005). A review of the historical context of assistive technology was provided in Chapter 1 in relation to the background of the problem. Therefore, the synthesis of the literature provided here, included a review of recent studies on assistive technology evaluation models as well as weakness in models presented.

The methodological rigor of previous research was assessed using quality indicators proposed by the Council for Exceptional Children (CEC; Odom et al., 2005) and refined focus in areas highlighted by Gersten and Edyburn (2007). In this regard a review on evaluation practices of computerized assistive technology devices and disabilities in education was conducted. The review of literature also addresses the practical and scholarly significance as related to the purpose of study. To provide a rationale for this study, this review discusses evaluation practices that have been influenced by current methodology and research.

The research method used in the study was quantitative ex-post facto descriptive. Based on literature review, the constructs and variables chosen appeared an appropriate starting point to determine the rationales of assistive technology practitioners when considering computerized assistive technology devices.

Assistive Technology Research

In 2005, the CEC developed a list of quality indicators that signified appropriate research in the field. Technology and Media division (TAM) of the CEC adopted these quality indicators, which were then elaborated on by Gersten and Edyburn (2007). This section discusses conceptual research models in assistive technology and outcomes of research. This discussion is followed by a review of computerized assistive technology outcomes in research associated with disabilities in education. Finally, this section concludes with a synopsis of implications for evaluation practices.

The three areas related to the constructs of this study are conceptual evaluation models, specific learning disabilities, and computerized assistive technology. Additionally, variables measured in this study included expertise of assessment, knowledge of specific learning disabilities, and computerized assistive technology devices. Current evaluation models and knowledge as they relate to specific learning disabilities and computerized assistive technology are also discussed.

Conceptual Evaluation Models

Because of the dynamics involved with assistive technology, an overview of evaluation practice followed by models of evaluation practice is necessary. Evaluation of assistive technologies involves three steps. Evaluation begins by determining whether an individual's disability warrants assistive technology. This process involves an assessment conducted to determine whether a service or device is warranted based on individual and environmental variables. Once determined necessary, assessment begins to determine what type of service or device needed to improve educational functioning and trials are implemented to gage success. The evaluation process relies on multiple interacting variables including the individual's motivation, capabilities, demand of functioning, and environmental context.

Watts, O'Brian, and Wojcik (2004) described four models of assistive technology, chambers consideration model (CCM, 1997), educational tech points (ETP; Bowser & Reed, 1995), SETT framework (Zabala, 1995), and unifying functional model (UFM; Melichar & Blackhurst, 1993). Consistent among all models is their focus on student outcomes that can be measured using longitudinal data (e.g., baseline, pre, and postcomparisons). Additionally, most models focus on a team approach for assistive technology evaluation. Common among these models is the theoretical framework of educational functional performance for outcome measurement (problem-based approach). This problem-based approach views these models in terms of functional academic performance and adaptive behaviors in the school setting. Etiology and remediation of the disability are not the focus. Rather, improvement of academic achievement and access to general education curriculum are primary goals.

One concern in using the problem-based framework is that any improvement in functional performance using an assistive technology device should yield a positive outcome (Gersten & Edyburn, 2007). In other words, one intervention may not demonstrate the best outcome compared to using a different assistive technology device; however, would show improvement.

Specific Learning Disabilities and Assistive Technology

Research influences the quality of assistive technology research in relation to specific learning disability evaluation. One of the most prevalent issues with specific learning disability research is its definition because the operational definitions associated with computerized assistive technology research with specific learning disabilities can affect the generalization of outcomes research.

The results of research are diagnostic evaluation models for specific learning disabilities. From a historical context, the traditional child-centered deficit model (CCD), relative achievement discrepancy model (RAD), and responsiveness to intervention model (RTI) are frequently cited in the literature regarding specific learning disabilities. Although other models are used in practice, the affect of these three models is greatest in identifying specific learning disabilities.

Generalization of assistive technology research outcomes typically includes academic performance as an indicator for success. An increase in academic performance (e.g., reading fluency, math skills) is used as a research outcome measure to evaluate the effectiveness of assistive technology for specific learning disabilities.

Computerized Assistive Technology

Research for computerized assistive technology devices is measured in terms of outcomes. However, research design and procedural fidelity with devices frequently cited in the literature are weak. A large part of this lack of strength in research is because computerized assistive technology devices are commercial. Rust and Smith (2006) found that 55% of commercial product developers used formal designs (e.g., single subject or group comparison design). They also found that 67% of reported client satisfaction was used in lieu of formal research design "at least half the time." Suggested research designs include comparison research (e.g., computerized assistive technology versus low-technology devices that support similar functions) (Reichle, 2011), time series concurrent differentials (TSDA) (Smith, 2000), and single subject designs (Edyburn, 2005). Lenker and Paquet (2004) conducted a meta-analysis of 89 studies on computer assisted technology outcomes and found that many key indicators were absent including inter-rater reliability (88%), content validity (90%), criterion validity (93%) and construct validity (92%).

Lack of procedural fidelity in outcome research is also a problem in assistive technology research for educational disabilities (Boone & Higgins, 2005; Golden, 1998) that creates difficulties in replication and validity (Reichle, 2011). Without procedural data, two professionals could yield entirely different outcomes when measuring outcomes of assistive technology device trials. Thus, procedural fidelity in computerized assistive technology research is a necessary component to ensure validity of devices becoming evidence-based practice (Yaw et al., 2011). Omissions in normative data because of procedural fidelity might contribute to the allure of some devices because of perceived or misperceived potentials to assure positive outcomes of an assessment.

A contributor to procedural fidelity is the use of standardized measurement to determine outcomes. However, non-standardized methods for measurement tools are frequently used in assistive technology outcome research in school settings. Edyburn (2005) and Rust and Smith (2006) substantiated that the frequency of use of formal instrumentation during commercial product development occurred 47% of the time when measuring functional performance outcomes.

Research design, validity, and procedural fidelity all affect the generalizability of computerized assistive technology devices. Specifically, these components ensure outcomes are generalizable and are based on the salient characteristics of the device. However, outcome reporting may not be based on sound research methods. An assistive technology device is partially defined as one that may be commercially acquired; the commercial nature of these devices affects research (IDEIA, 2004).

Research Quantity

Research on assistive technology as a whole is still new compared to research in other areas of special education (Edyburn, 2005). The limited availability of research-based outcomes makes it difficult to determine whether devices are effective for specific learning disabilities. Edyburn (2011) suggested conducting a meta-analysis to determine whether certain assistive technology interventions could be considered evidence-based practices for educational disabilities. However, such a study would require clear operational definitions for computerized assistive technology and specific learning disabilities.

Autism has heterogeneity to its population similar to that of specific learning disabilities and can serve as a model for research. Due to the consistent use of operational definitions and adherence to quality indicators in autism research have yielded evidence-based assistive technology practices, which had not occurred for individuals identified with specific learning disabilities.

Video modeling is one example of a computerized assistive technology that meets the criteria for an evidence-based practice for autism. Video modeling was developed through a meta-analysis that included experimental and single-subject research design. Reichow, Doehring, Cicchetti, and Volkmar (2012) identified quality indicators from meta-analyses of single-subject research design studies that focused on autism. Primary quality indicators of single-subject experimental designs included an explanation of participant characteristics using operational definitions, clearly defined variables, baseline conditions, and visual analysis. Notable secondary quality indicators were generalization and fidelity of implementation. Cohen (1988) suggested an effect size of greater than $d = 0.5$ to determine evidence-based practices. According to Gersten and Edyburn (2007), assistive technology researchers need to use quality indicators in their meta-analyses to determine whether the use of certain devices represent evidence-based practice. This concept can be broadened for computerized assistive technology for specific learning disabilities.

Implications of Research Quality and Quantity on Current Practices

Research suggests that practitioners focus on compliance issues and may rely on contextual fit to a detriment. Therefore, the following section discusses practitioners' focuses on compliance and overreliance on contextual fit as guidance in evaluation decisions. This section concludes with a description of implications of both practices.

Over Reliance on Public Policy

Greater weight is often placed on compliance of federal law rather than evaluative best practices because of issues with the quantity and quality of assistive technology research (Gersten & Edyburn, 2007). In this regard, components that address compliance include state interpretations, documentation, and software management tools.

State educational agencies (SEAs) must provide proof that they are compliant with IDEIA to receive funding to deliver services. States have tremendous latitude in the way that IDEIA is interpreted (Reed & Bowser, 2005). Unfortunately, documentation practices set forth by SEAs to prove compliance is minimal (Edyburn, 2002) and do not guarantee that best practices are followed.

Bausch et al. (2009) examined state policy and IEPs of assistive technology and reviewed documented practices regarding assistive technology decisions to find evidence of whether best practices were occurring with assistive technology. The researchers found that eight the 10 states studied had documented policy and procedures for assistive technology evaluation. Further analysis of the IEPs showed that most lacked documented rationales as part of the assistive technology determination.

Compliance documentation frequently requires the use of special education software; however, this software can hamper best practices. In an analysis of IEP software typically used by districts, Haines and Robertson (2005) suggested that special education software emphasizes compliance and efficiency but does not provide tools to support collaboration, which is a suggested best practice for assistive technology evaluation.

Over Reliance of Contextual Fit

Assistive technology practitioners may overly rely on the degree of contextual fit for assistive technology assessment decisions in the absence of valid empirical data. Contextual fit is the extent to which the components of an assistive technology evaluation are consistent with the values, expertise, and resources to support the implementer (typically the teacher) of the assistive technology plan (Reichle, 2011). If overly relied on, contextual fit may influence the validity and generalization of assistive technology (Yaw et al., 2011). Contextual fit is further influenced by the degree of expertise and pedagogical influence (Lahm & Sizemore, 2002; NCED, 2011).

Pedagogical influence begins at the professional preparation level and influences evaluative assistive technology practices (Yaw et al., 2011). Professional preparation programs for assistive technology are found in a variety of disciplines (i.e. engineering, occupational therapy; therefore, confusion may exist with how assistive technology is implemented in schools. The purpose of these programs is to promote rehabilitation and function as opposed to access to general education curriculum (National Center for Educational Statistics [NCES], 2012). The focus of professional preparation varies in programs in ergonomics, universal environment systems design, rehabilitation biomechanics, microprocessor-based technologies, research, and service delivery management (NCES, 2012).

The Council for Exceptional Children (CEC, 2003) developed competencies for assistive technology practitioners for special education. However, because reports indicated a lack of comfort with devices and procedures by special education teachers, it is questionable whether these competencies were actually being addressed. Factors described included lack of knowledge of devices, lack of experience with instructional technology strategies, and lack of comfort with assistive technology evaluation

Zabala and Carl (2005) referenced the QIAT listserv, which discusses quality indicators in assistive technology. The listserv has over 950 subscribers from the United States and other countries, and guides various aspects of research and professional practice. The researchers outlined common errors in the area of assistive technology based on subscribers' responses. Reported issues included lack of training that assistive technology knowledge was considered for severe disabilities only.

Abner and Lahm (2002) reported similar findings in a survey that measured the self- reported confidence of 72 teachers who served visually impaired students in the area of computerized assistive technology. Teachers also provided information regarding their caseload, which included a total of 565 students. The findings indicated that 51% of teachers were at the apprentice level for teaching the use of assistive technology to their students. Additionally, 99% of respondents stated that they needed more training. Of training received, 88% participated in in-service workshops, and 49% of vision teachers stated they did not feel competent enough to use assistive technology.

Abner and Lahm (2002) also analyzed the amount and type of assistive technology that students used. The study reported that although 50% of students were identified with multiple disabilities, only 12% used switches. This percentage would be projected much higher in light of the involvement of disabilities. Additionally, 1% of students used e-texts. Again, this finding was projected to be higher given the ease of the devices compared to text-to-speech synthesizers.

Device knowledge is a factor of contextual fit and knowledge of computerized assistive technology devices, which may be limited due to pedagogical preparation. Based on type of professional licensing or credentialing, an assistive technology practitioner may have only discipline-specific knowledge in terms of appropriate computerized assistive technology devices. For example, teachers with certification in vision or hearing impairments are qualified to evaluate and work only with students with those disabilities. Similarly, speech language pathologists with specific training in communication assistive technology (e.g., augmentative and alternative communication devices [AAC]) are qualified to evaluate and work only with students who have severe communication deficits. Special education teachers serve students with high-incidence disabilities, such as specific learning disabilities.

In light of the pedagogical influences that affect the level of knowledge of assistive technology devices and practices, reliance on opinion may reign in evaluation. Examples of this reliance include computerized assistive technology decisions that are influenced by ideology (Blackhurst, 2005) and consumer satisfaction (Gersten & Edyburn, 2007) rather than empirical data. Ideology implies that the IDEIA or hope that assistive technology devices are capable based on their potential to increase outcomes rather than be research based. Consumer satisfaction refers to the level of buy-in of the assistive technology receiver. Ideology and marked improvement in function, regardless of documented increases, can contribute to consumer satisfaction and is not necessarily researched based.

Need for a Multidisciplinary Team

Successful evaluation begins with the collective knowledge and collaboration of members of a multidisciplinary team because the field of assistive technology is interdisciplinary (QIAT, 2012). To mitigate issues associated with contextual fit and public policy focus, researchers have suggested the use of a multidisciplinary team. Reed (2007) noted that, in the absence of collaboration, there is a greater likelihood in unsuccessful outcomes with assistive technology devices.

However, some states lack a policy for multidisciplinary teams that conduct assistive technology evaluations (Bausch et al., 2009). According to Zabala and Carl (2005), a team approach to assessment is rarely used. They also note that, if individuals who participate in an assessment do not have the necessary skills, it is rare that they seek collaboration (Zabala & Carl, 2005).

Based on computerized hardware and software becoming smaller and less expensive (U.S. Bureau of Labor Statistics [BLS], 2010), outcome comparisons in research between computerized assistive technology, low technology, and districts' development of larger technology infrastructures, computerized assistive technology devices will continue to increase as an area of consideration for evaluation. Compliance documentation and pedagogical influences will also be areas of focus. Thus, the suggested research practice of collaboration can facilitate computerized assistive technology consideration practices.

Disproportionate use of Assistive Technology

Historically, assistive technology has been used to compensate for severe communication or physical impairments, which are considered low-incidence disabilities (Zabala & Carl, 2005). The term *low-incidence* is used by public schools to describe the rate of occurrence of a disability (e.g., autism) that occurs in approximately 1% of the special education population. Golden (1998) compared projected assistive technology use between low- and high-incidence disability groups and found that low-incidence groups had a projected use rate of 100% compared to 35% for high-incidence disability groups including specific learning disabilities. While learning disabilities comprise 41% of disabilities in schools (Lyon, 1996), the use of assistive technology for these disabilities is approximately 16% (Quinn et al., 2009). Additionally, although low-incidence disabilities are found in 1% of the school-aged population, 54% of this group receive assistive technology services (Behrmann and Jerome, 2002; Edyburn, 2000).

The use of assistive technology is disproportionate in other ways as well. Quinn et al. (2009) measured the frequency of assistive technology use based on ethnicity and least restrictive environment (LRE). The sample included at all grades (pre-K-12) with the largest percentage of students receiving services in self-contained settings (40%). The most common disability was multiple disabilities (27%). The results indicate that the greater the restrictiveness of the educational environment, the greater frequency of assistive technology use. Regarding the ethnicities of students who received assistive technology, 25% were Caucasian, 25% Hispanic, and 9% African American.

A contributing factor to these disproportionate practices and questions concerning a lack of quality of research of computerized assistive technology with specific learning disabilities could be related to the self-efficacy of assistive technology practitioners. Self-efficacy, which is based on social cognition theory, refers to the belief and accuracy of competency. Social cognition theory holds that individuals' capabilities and knowledge in a particular field is affected by their beliefs about their competency, which shapes behaviors (Bandura, 1986).

Self-efficacy can affect performance positively or negatively (Bandura, 1986). For example, individuals avoid tasks that exceed their capabilities; therefore, self-efficacy may serve as a predictor of which assessment methods will be used in the evaluation of computerized assistive technology for specific learning disabilities. As noted, knowledge of the applications of computerized assistive technology to certain subpopulations of disabilities does not imply knowledge of applications for all disabilities. Both low and inflated self-efficacy of assistive technology could contribute to less-than-adequate assessments and decisions about assistive technology devices.

Rationale for Study Based on a Review of the Literature

Because of the limited extant research on outcomes of computerized assistive technology for specific learning disabilities, assumptions were made based using literature that covered broader issues. These issues focused on assistive technology evaluation research in general and in terms of disabilities in education. The assumptions were based on the following factors. First, evaluation practices of computerized assistive technology and specific learning disabilities warrant further focus. Second, based on these broader issues, computerized assistive technology was defined operationally. Third, the intended outcomes of computerized assistive technology for subpopulations of specific learning disabilities were included.

The literature review also revealed gaps in research to practice for assistive technology evaluation. Examples were given to support this point regarding evaluation practices of collaboration, which was also a focus of this study. Further, this study contributes to the body of empirical research in that it delineated operational definitions and intent of intervention of computerized assistive technology, created tighter operational definitions of specific learning disabilities in relation to assistive technology research, and determined whether the suggested evaluation practice of collaboration based on research occurs.

This study also contributes to evaluation practices by bridging the research to practice gap. Specifically, this study compared self-reported knowledge base between professional groupings and contributed to self-reported collaborative practices. The research also described the self-reported expertise of assistive technology practitioners in computerized assistive technology and specific learning disabilities. Finally, the findings served to determine differences in self-reported expertise between participants who collaborate versus those who do not when matching computerized assistive technology with students identified with having specific learning disabilities.

CHAPTER III

METHODOLOGY

The purpose of this study was to describe the knowledge of assistive technology professionals that influence evaluation practices when considering computerized assistive technology for students identified with specific learning disabilities. A quantitative, descriptive ex post facto research design was used for the study. The design was chosen to generate empirical data. As stated in Chapter II, limited empirical data exist regarding this topic of study.

Research Design

The study used a survey administered online to professionals involved with assistive technology decisions. The participants were located through the listservs of professional organizations associated with assistive technology. Gay, Mills, and Airasian (2010) noted that the advantages of online survey distribution include the ease of targeting respondents, confidentiality, anonymity, and standardization of administration.

Participants

Assistive technology practitioners are professionals involved in the evaluation of assistive technology to create functional access for persons with disabilities. Because assistive technology providers come from diverse backgrounds and serve medical and educational disabilities, they were narrowed to researchers and practitioners whose focus is providing access for individuals identified with disabilities in education. An online survey was distributed nationally to members of assistive technology, thus a purposive sample was collected.

The participants were disaggregated into four service provider groups. Because specific learning disabilities is a population of individuals served in education, study participants were grouped according to typical professional service groupings as documented in IEPs. These groupings included related service providers, special education specialists, and general education instructional specialists. A fourth group comprised of education technology providers such as librarians and other computerized technology support roles and specializations (see Table 3.1).

Table 3.1

Professional Service Groups

Service Group	Professional Licensing or Credentialing
Related Service	Occupational Therapist, Physical Therapist, Adaptive P.E. Teacher, Vision Itinerant Teacher, Auditory Itinerant Teacher, Behaviorist
Special Education Specialist	Licensed School Psychologist, Educational Diagnostician, Psychometrician, Special Education Specialist
Instructional Service	Speech Language Pathologist, Reading Teacher, Content Mastery, General Education
Educational Technology	Educational Technology, Computerized Instruction, Librarian

Research Questions

The following research questions guided this study:

1. What is the expertise of assistive technology practitioners in computerized assistive technology?
2. What is the expertise of assistive technology practitioners regarding specific learning disabilities?
3. What is the self-reported expertise of assistive technology practitioners when evaluating computerized assistive technology for students identified with specific learning disabilities?
4. Is there a difference in self-reported expertise between participants who collaborate versus those who do not when matching computerized assistive technology with students identified with specific learning disabilities?

Survey Instrumentation

The first step in survey research, if an appropriate survey is not available, is to design one. At the time of the literature review, a survey instrument to measure the expertise of assistive technology practitioners in the evaluation of computerized assistive technology for individuals with specific learning disabilities was not available. Groves et al. (2009) provided recommendations to develop a valid survey, which included determining the constructs, developing a sampling frame, and choosing a method of analysis to assess reliability and validity. This section outlines the purpose, procedure, participants, qualitative and quantitative research methods for the survey development.

Procedure

Instrument development involved four steps. Step 1 consisted of defining the constructs based on the review of literature. Step 2 involved generating items that measured the constructs. Step 3 included designing and determining whether the survey tool was a valid and reliable measure. Step 4 involved determining the validity and reliability via a pilot study of the tool using qualitative and quantitative research methods.

A literature review was conducted to determine the following relevant constructs: (a) practitioners' use of collaboration during an evaluation for computerized assistive technology, (b) practitioners' knowledge and levels of expertise of computerized assistive technology, (c) practitioners' knowledge and levels of expertise of specific learning disabilities, and (d) practitioners' levels of expertise when matching computerized assistive technology with the needs of students identified with specific learning disabilities (Devellis, 2012).

Pilot Study

The pilot study comprised of a focus group and statistical analysis of the survey tool. Participants for the pilot study included faculty committee members, an expert in assistive technology assessment framework, and professionals involved in implementation or assessment decisions of assistive technology assessment for students (K-12).

The pilot study involved two phases. In the first phase, participants were sent an invitation and emailed a link to the survey. They were then asked to analyze the face validity and determine items that represented the constructs measured to determine construct validity. Focus group participants offered suggestions regarding ease of use, clarity, and readability. Modifications to the survey were made in the areas based on focus group input. Discussion with the focus group also included queries regarding test questions because of skewed results. Based on these results and elaboration with the focus group, modifications were made to the survey.

Content validity was analyzed by expert and faculty participants. This process established the credibility, accuracy, and relevance regarding the domain of the instrument. Criterion validity could not be determined because another tool was not available for comparison.

The second phase of the pilot study was based on the results of the initial focus group. During this phase, the survey was modified, re-administered, and analyzed statistically to determine reliability. Survey responses were analyzed using SPSS. Cronbach's alpha was used to provide an estimate of the internal consistency of the scores derived from the scale. This calculation was done to determine reliability of the survey. Cronbach's alpha was calculated for each set of response items that represented the constructs. Fowler (2009) stated that an alpha between 0.6 and 0.8 indicated adequate reliability. All scores yielded a Cronbach's alpha composite score that showed internal consistency in the variance of test items ($\alpha = .937$). Each item was measured for inter-item correlations to determine whether reliability would increase or decrease by removing individual test questions. No removal of test items was done based on the comparison of the Cronbach's alpha composite score. After both phases of the pilot study were complete, the survey was approved by the university Institutional Review Board for modifications and was cleared for use for this study (Appendix A).

Administration of the Survey

The survey was administered to assistive technology practitioners. Assistive technology practitioners were identified as professionals involved with the evaluation of assistive technology to create functional access for persons with disabilities. Because assistive technology providers come from diverse backgrounds and serve medical and educational disabilities, assistive technology practitioner groups were narrowed to researchers and practitioners whose focus was providing access for individuals identified with educational disabilities. An online survey was nationally distributed to assistive technology organizations. Known as a purposive sample, a true stratified randomized sample was not obtained for purposes of the study.

Participants, found through assistive technology organizations, were solicited by email and received a cover letter and link to the survey. The cover letter contained the purpose of study, request for the potential respondent's cooperation, the estimated time to complete the survey, and the deadline for participation. Participation was voluntary, confidential, and anonymous. The following informed consent statement was included: "Participation by following the hyperlink below indicates that you have read and understand the information provided above, that you willingly agree to participate, that you may withdraw your consent at any time and discontinue participation without penalty, and that you are not waiving any legal claims." Participants were given 3 weeks to complete the study, at which time data collection was complete. The survey was distributed via PsychData.com, and the link was available for 3 weeks.

Data Analysis

The research questions were answered using descriptive data analysis or ANOVA. Participants' responses were analyzed by creating combined independent and dependent variables. A one-way analysis of variance (ANOVA) and a description of frequencies was used to determine differences between the dependent variables (self-reported level of device knowledge, learning disability knowledge, expertise and frequency) among the four professional groups. Statistical Package for Social Sciences (SPSS), version 14.0 software was used for data analysis. Descriptive statistical analysis was chosen to determine patterns in the data that described variables associated with assessment decisions.

Determination of Variables

The variables were combined and mean responses that represented the constructs were used. Individual items used to represent the constructs were referenced from a variety of sources. The determination of computerized assistive technology devices used for the study was based on Reed (2007), and a synthesis of literature provided by Edyburn (2002; 2003; 2004). The determination of variables of specific learning disabilities and topics were referenced from IDEIA (2004) and Swanson, Harris, and Graham (2003). The independent variables in the study consisted of assistive technology participants, which were separated according to professional roles represented in an IEP. Collaboration was an independent variable.

The dependent variables were sets of data combined to represent the following constructs: (1) computerized device knowledge, (2) knowledge of topics relating to specific learning disabilities, (3) self-reported expertise of assessment of involving computerized device knowledge with specific learning disabilities, (4) and frequency of consideration of the computerized devices for specific learning disabilities. Combining individual responses to a set of responses resulted in a mean score comparison to reduce respondent bias. For example, respondents' knowledge regarding a particular computerized device was not the focus; rather, the collective mean of the set of questions that represented overall knowledge of computerized assistive technology devices was the focus.

CHAPTER IV

RESULTS

The purpose of this study was to describe the extent of knowledge of assistive technology providers when matching computerized assistive technology devices with students with specific learning disabilities. Limited research exits in this regard because of changes in computerized devices and the flux of the professional best practices of assistive technology as a whole. The study examined the overall expertise with matching computerized assistive technology devices with specific learning disabilities. The groups studied included (1) related service providers, (2) special education specialists, (3) general education instructional specialists, and (4) education technology specialists. Expertise was determined based on the following four constructs: (1) knowledge of specific learning disabilities, (2) computerized assistive technology, (3) self-reported expertise, and (4) frequency of consideration. Collaboration, was addressed in Research Question 4 in which the findings yielded significant differences. Data were collected by survey and analyzed using a comparison of means and analysis of variance regarding collaboration.

In this chapter, two types of results are provided. The first set of results includes a description of knowledge and frequency of expertise in terms the comparison of means among the four groups. Second, an analysis of variance (ANOVA) was used to compare collaboration among the constructs. Based on the literature review collaboration was expected contribute to differences in knowledge, expertise, and frequency of consideration. The research questions were chosen to reflect current level of knowledge and whether collaboration influenced differences reported by respondents.

The mean scale scores were collected by measuring expertise in matching computerized assistive technology to specific learning disabilities. Of the 80 respondents, 51 met criteria for inclusion of the study based on the four professional groupings. The descriptive statistics that follow report the results of Research Questions 1, 2, and 3, which describe the level of knowledge, expertise, and frequency of consideration in comparison among four groups. The descriptive statistics indicated similar means with respect to frequency of consideration and levels of knowledge of computerized assistive technology. Differences in mean scores were found with respect to levels of knowledge of specific learning disabilities and expertise. Significant differences were noted with respect to Research Question 4, which addressed collaboration.

Results for Research Question One

The first research question addressed the levels of knowledge of assistive technology providers as it related to computerized assistive technology devices. Mean scores were calculated based on overall level of knowledge of devices. Knowledge was represented using a 4-point Likert scale, and percentage responses were provided in quadrants. Mean and standard deviation were calculated and compared among the four professional groups. Table 4.1 presents the mean and standard deviations of the four groups' responses regarding computerized assistive technology device knowledge. The overall mean and standard deviation of the groups are compared to illustrate differences.

Table 4.1

Overall Knowledge of Computerized Assistive Technology Devices

	N	M	SD
General Instructional Specialists	13	3.07	.869
Special Education Specialists	17	3.24	.559
Related Service Providers	24	3.30	.654
Educational Technology Specialists	18	3.15	.703

Results for Research Question Two

The second research question addressed the level of knowledge of assistive technology providers as it related to specific learning disabilities. Mean scores were calculated based on overall knowledge of specific learning disabilities. Mean and standard deviation were calculated and compared among each of the four groups regarding specific learning disabilities.

Table 4.2 presents the mean and standard deviation in comparing each of the four groups' responses regarding knowledge of specific learning disabilities. The mean scores were calculated based on a 4-point Likert-type scale (none-expert). The overall mean scores and standard deviation of the groups are presented to illustrate differences. Some difference existed when comparing the knowledge of computerized devices across groups. While three of the four groups reported a level of knowledge described as average, educational technologists were below average in comparison (*M* = 2.72, *SD* = .528).

Table 4.2

Overall Knowledge of Specific Learning Disabilities

	N	M	SD
General Instructional Specialists	13	3.19	.755
Special Education Specialists	17	3.36	.52
Related Service Providers	24	3.05	.461
Educational Technology Specialists	18	2.72	.528

Results for Research Question Three

The third research question described assistive technology providers' expertise in matching computerized assistive technology with individuals with specific learning disabilities. This question was answered in two ways. First, the mean set of self-reported responses on expertise when matching computerized assistive technology with specific learning disabilities was compared among the four groups (see Table 4.3). The mean scores were calculated based on a 4-point Likert-type scale (none-expert). The overall mean scores and standard deviation of the groups presented are compared to illustrate differences. As a group, educational technology specialists reported slightly below average expertise (*M* = 2.92, *SD* = .874) compared to an average level of expertise with the other three groups.

Table 4.3

Self-Reported Expertise

	N	M	SD
General Instructional Specialists	12	3.05	.922
Special Education Specialists	16	3.27	.458
Related Service Providers	24	3.19	.68
Educational Technology Specialists	18	2.92	.874

Table 4.4 presents the means and standard deviations of the frequency of consideration for pairing computerized devices with specific learning disabilities. The mean scores were calculated based on a 4-point Likert-type scale (never-always). The overall mean scores and standard deviation of the groups presented are compared to illustrate differences. Some differences existed when comparing the levels of expertise across groups. However, the level of consideration for all groups was that computerized assistive technology devices, as a whole, were somewhat considered for individuals with learning disabilities.

Table 4.4

Frequency of Consideration of Devices

	N	M	SD
General Instructional Specialists	11	2.23	.613
Special Education Specialists	16	2.33	.499
Related Service Providers	23	2.36	.444
Educational Technology Specialists	17	2.29	.542

Results for Research Question Four

The fourth research question addressed differences in self-reported expertise between participants and their levels of collaboration when matching computerized assistive technology with students identified with specific learning disabilities. The mean of a set of responses were analyzed in terms of the following: (1) common topics associated with learning disabilities, (2) knowledge of computerized assistive technology devices, (3) frequency of consideration for both areas, and (4) self-reported expertise for consideration of a computerized assistive technology device for specific learning disabilities (i.e. assessment). A one-way analysis of variance (ANOVA) was completed to compare means. A significant difference existed when comparing collaboration among the constructs (see Table 4.5).

Table 4.5

Collaboration

	df	F	Sig.
Specific Learning Disability Knowledge	4	1.167	.341
Computerized Assistive Technology Device Knowledge	4	1.609	.193
Frequency of Consideration	4	.443	.776
Expertise in Assessment for Both	4	1.690	.174

A significant main effect existed for collaboration in each of the four constructs. A significant difference was also found regarding the effect of collaboration on knowledge of specific learning disabilities, $F(4, 37) = 1.17$, $p = .34$. A significant difference was found regarding the effect of collaboration on knowledge of computerized assistive technology device knowledge, $F(4, 37) = 1.16$, $p = .19$. A significant difference was found regarding the effect of collaboration on frequency of consideration, $F(4, 34) = .44$, $p = .78$. Finally, a significant difference was found regarding the effect of collaboration on expertise of matching computerized assistive technology devices with specific learning disabilities, $F(4, 36) = 1.69$, $p = .174$.

CHAPTER V

DISCUSSION

The purpose of this study was to describe the expertise of assistive technology providers when matching computerized assistive technology devices with students with specific learning disabilities. Limited research exists in this regard due to the flux with computerized device technology and limited best practices as a whole. This chapter opens with significant findings associated with collaboration and their affect on current assessment practices. This discussion is followed by findings that describe differences among professional groups, which was accomplished by creating combined dependent variables that represented four constructs necessary for matching computerized assistive technology devices with specific learning disabilities. The chapter closes with a summary of the implications for practice and suggestions for further research.

Collaboration

Collaboration represented the most significant findings of the study. Four constructs, combined dependent variables, were measured for significance between participants and their levels of collaboration. The constructs that represented expertise included combined variables representing (1) knowledge of specific learning disabilities, (2) knowledge of computerized assistive technology, (3) self-reported expertise, and (4) frequency of consideration. Overall, levels of collaboration contributed to significant differences among the four constructs that affect the assessment of computerized assistive technology with specific learning disabilities. Each of the constructs is discussed separately.

Collaboration and Computerized Assistive Technology Knowledge

Significant differences were found in reported computerized assistive technology device knowledge by assistive technology professionals based on their levels of collaboration. Thus, collaboration contributed to greater ratings in knowledge in computerized assistive technology for assistive technology professionals. This finding supports similar research that suggested collaboration is vital for assistive technology practices. Reed (2007) found that, in the absence of collaboration, there is greater likelihood of unsuccessful outcomes for assistive technology. This finding may also give further clarification as to why unsuccessful outcomes are occurring. Respondents also reported a significant difference in expertise when collaboration was a part of the evaluation process for matching computerized assistive technology devices with specific learning disabilities.

Collaboration and Specific Learning Disability Knowledge

Significant differences were found in reported knowledge of specific learning disabilities by assistive technology professionals according to their levels of collaboration. The fact that collaboration levels contributed to significant differences in learning disability knowledge suggest that knowledge of specific learning disabilities is necessary, and there is room for improvement. Consensus of the theoretical framework for evaluating specific learning disabilities would help create constant operational definitions to achieve such a task.

Collaboration and Self-Reported Expertise

Significant differences were found in self-reported expertise when matching computerized devices with specific learning disabilities by assistive technology professionals according to their level of collaboration. Collaboration contributed to greater ratings in expertise for assistive technology professionals. The significance of this result is important because self-reported expertise alone may be less subjective than assumed. Because collaboration contributed to differences in reported competence, it could be presumed that self-efficacy of those who collaborate in general is high.

Collaboration and Frequency of Consideration

Significant differences were found in frequency of consideration by assistive technology professionals according to their levels of collaboration. The significance of these results are particularly important in that it supports current research and has implications for further research. By demonstrating the significance of collaboration, these results suggest that computerized devices are not used as frequently for specific learning disabilities as could be. Although of narrow scope in terms of the type of assistive technology and disability served, these findings support the broader research that suggests assistive technology is under used (i.e., Bausch et. al, 2009; Zabala & Carl, 2005). The results of collaboration as they relate to frequency suggest that other factors may influence decision-making practices when considering computerized devices for specific learning disabilities. Furthermore, it suggests other differences may warrant further consideration for research as well.

Descriptive Analysis of Knowledge, Expertise, and Frequency

Other differences were reported in the study and described in the comparison between professional groupings typically documented in IEPs. These four groups included (1) general education instructional specialists, (2) special education specialists, (3) related service providers, and (4) educational technology specialists. The study yielded interesting findings based on the comparisons of the four professional groups that would not have been found had respondents not been separated in this fashion. Aside from collaboration, differences in the constructs comprising expertise were noted. These constructs included knowledge in specific learning disabilities, knowledge in computerized assistive technology devices, frequency, and self-reported expertise. Similarities and differences were noted in comparisons of the groups, which may suggest a need for further study.

Knowledge of Specific Learning Disabilities

Differences were found in the reported knowledge of specific learning disabilities among assistive technology professional groups. Educational technology specialists were the least knowledgeable as a group and reported less than average knowledge compared to the average ratings of the other three groups. Educational technologists, as a group, primarily comprised of individuals with professional expertise in computerized technology and applications in education. Primary emphasis in this field is computerized software and hardware. Differences in the knowledge regarding specific learning disabilities may be because educational technologists formulate the inventory of technology available at school districts.

The differences in results among groups may give greater support to the argument posited by Yaw et al. (2008) in that contextual fit is frequently considered in assistive technology decisions. However, this factor is difficult to control with current conceptual evaluation models described in the literature review for assistive technology. This finding suggests that a lack of knowledge on specific learning disabilities could contribute to over reliance of contextual fit and contribute to procurement decisions; therefore, further research is needed.

Knowledge of Computerized Assistive Technology

All groups reported average knowledge of computerized assistive technology devices by assistive technology professional groups. Speculatively speaking, this finding may be due to the emergence of many computerized assistive technology devices; therefore, knowledge base and comfort may be the same. For example, more districts are adopting a bring your own device (BYOD) policy at the secondary level. Additionally, Universal Design for Learning (UDL) initiatives also support inclusion through computerized technology and increased exposure.

Expertise

Differences were found in reported knowledge of specific learning disabilities by assistive technology professional groups. These results supplement the finding of Abner and Lahm (2002), which suggest that lags in perceptions of competency for assistive technology expertise still occur. Although the scope of focus was narrowed to educational technology professionals for the purposes of the study, the results can still be broadened to describe the factors that influence expertise.

Frequency

Differences were found in reported frequency of consideration by assistive technology professional groups. While all four groups reported similar means in frequency, the result was lower than expected in comparison to the other constructs. Frequency of consideration of computerized assistive technology devices for specific learning disabilities was reported as occasionally considered. Examining this data alone could lead to the assumption that either the devices were not appropriate for specific learning disabilities, only occasional consideration of the devices was appropriate, or a different data analysis should have been used.

A significant difference was noted regarding levels of collaboration and frequency of consideration. This significant finding suggests a greater potential in consideration practices for computerized devices for specific learning disabilities. Based on the results of collaboration, consideration of computerized devices is not considered enough for specific learning disabilities. Furthermore, the high interrater reliability obtained during the pilot study supports the appropriateness of the devices as representing the construct measured ($\alpha = .937$). Both of these findings support the validity of the result for frequency. Therefore, the construct of computerized assistive technology devices was accurately described. The results of the study show that computerized assistive technology devices could be considered more often for specific learning disabilities.

Implications for Practice

The study supports research on the necessity of collaboration in assistive technology. Results of the study provide greater guidance and support Bodine and

Melanis' (2005) suggestion for transdisciplinary assessment teams because of differences among professional groups with respect to knowledge and expertise in given areas. Collaboration and type of collaboration, including transdisciplinary teaming, will help bridge these differences.

Collaboration is not a new concept in education and transdisciplinary teams are a preferred team model for collaboration in special education. The transdisciplinary model provides a type of assessment where discipline lines are blurred, and expertise and assessment are shared by professionals of diverse backgrounds for a common goal. This approach not only guides the assessment process but guides service delivery as well. It also builds knowledge in the constructs reported as lacking in the study. A greater investment of all professionals occurs during the consideration process and assures FAPE. Additionally, a greater number of individuals involved in the process creates a greater continuum of options. Therefore, the reliance of contextual fit lessens as does the risk of abandonment of the assistive technology.

The findings of the study also have implications for changes in assessment practices for specific learning disabilities with assistive technology. Specifically, it may be necessary to question whether current models are enough to guide decision-making practices for this population. In particular, as is relates to matching computerized devices to specific learning disabilities, additional tools may need to be developed to supplement current assessment framework. Such tool development could be done by understanding that the focus of consideration is on technologically-enhanced performance (Edyburn, 2005) for specific cognitive processing deficits, which represent the scope of this study.

The degree of performance enhancement and type of processing deficits can be overlooked using current assistive technology frameworks. This is not to say that this occurs among all professionals. However, based on the results of the study, these deficits do occur. Therefore, a shift in perception is required for professionals to embrace a theoretical knowledge that goes beyond focusing on a functional outcome of a device or a problem-based approach.

Current framework options require a supplemental theoretical base when making assistive technology decisions for specific learning disabilities. This can be found in assessment models for identifying specific learning disabilities, and means that practitioners may need a theoretical understanding (e.g., of the Luria theory or CHC theory) to assist in the identification of specific learning disabilities. The operational definitions created using these theories can also facilitate appropriate decision making by providing a depth of assessment, which is intrinsic to the individual.

While the trend in educational research is to shun a deficit model for assessment, the truth remains that a deficit will always be prevalent to identify a specific learning disability. Whether a deficit occurs in comparison to peers, standards, curriculum, or intra-individual, it must be present for the identification for specific learning disabilities. By incorporating cognitive processing models with the functional framework for assistive technology assessment, a common language can be created among practitioners. While a functional framework describes the observed behavior (e.g., reading comprehension difficulties), the proposed cognitive processing models serve as supplements by describing why the behavior is occurring (e.g., long-term retrieval). This process yields a depth of information that would not be available by matching a device based on functional outcome alone. It also creates a tighter decision-making process when matching computerized assistive technology with learning disabilities, and lessens the chance of abandonment because of greater clarity in outcomes measured during device trials.

The rationale for incorporating the suggested theoretical models with assistive technology framework is best illustrated by the results of the study. Educational technologists' low levels of knowledge in specific learning disabilities and low levels of expertise in consideration for computerized devices were reported. This finding was in spite of the fact that their self-reported knowledge of computerized assistive technology devices was high. The findings of the study imply that specialists with the sole focus on educational technology may be at a disadvantage regarding collective knowledge to serve students with specific learning disabilities. Broadly speaking, knowledge of technology does not imply a full understanding of its applications for disabilities. With lower expertise reported by educational technologists for consideration decisions and knowledge of specific learning disabilities, sole reliance on professionals with expertise in general technology is inappropriate for decisions involving assistive technology for students with specific learning disabilities. As a profession, assistive technology decision makers are aware of this disadvantage. However, the practice still occurs, which has far reaching implications with device abandonment, unnecessary costs for procurement, and FAPE.

The levels of frequency of consideration reported not only with educational technologists but among all groups imply that greater diligence is needed for assistive technology to provide FAPE. Knowledge levels of assistive technology, or lack thereof, can be barriers to providing FAPE. An assurance of FAPE cannot be fully determined if a continuum of devices is not at hand or if a full understanding is not obtained for their potential applications to particular disabilities. As reported by Lahm (2005), the goal of assistive technology is to provide greater independence. Those with disabilities are still required to have competence in computerized technology just as their peers not identified with disabilities. By not considering computerized assistive technology for students with specific learning disabilities, a greater gap and dependence remain.

Barriers to FAPE have secondary implications that include device abandonment and unnecessary costs for procurement. Device abandonment occurs for a number of reasons. However, abandonment could occur simply because the device did not provide the greater degree of independence. Abandonment of devices and procurement of devices without understanding the full needs of diverse learners has costly results. These results become a continuum of assistive technology that is obsolete.

While it is easy to conceptualize a need for computerized technology to serve diverse populations, it is difficult to achieve. A barrier to improvement in this area is the speed at which computerized technology is changing, which require changes in skill set by readdressing competencies regarding specific learning disabilities relating to assistive technology. The Rehabilitation Engineering Assistive Technology Society of North America (RESNA) developed competencies for those responsible for implementing assistive technology. The requirements for certification include competencies for vision, hearing, communication, adaptive, and mobility issues. However, cognitive disabilities, whether mild or severe, are excluded from these core competencies. While RESNA is not involved in the certification and licensing criteria for professionals in education per se, it does influence the course of assistive technology for the future.

The role of RESNA has implications for certification programs in higher education settings. Knowledge in one area is not enough to contribute to expertise when pairing a continuum of assistive technology options to one of abilities. Just as assistive technology is meant to be infused into curriculum to support students with disabilities, assistive technology applications must be infused into methods and preparation courses for preservice professionals. In the preservice curriculum, the first step involves describing foundational knowledge. Infusing the requirements takes time, but it is not impossible, particularly when descriptions and competencies contribute to tighter operational definitions. This study contributed to the discussion of necessary competencies for an emerging field; that is, matching computerized assistive technology with specific learning disabilities.

Implications for Future Research

The implications discussed for practice extend to implications for research. Frequency, knowledge, and collaboration were discussed as areas of need to bridge the research to practice gap. This study showed that differences exist, some significant, which warrants further study. The areas of suggested research include evaluative models and predictive analysis among constructs.

While differences were found, the questions remain as to the degree that constructs affect expertise and whether further correlations can be drawn from the data. Further research should be considered by correlating levels of expertise with frequency of consideration for computerized assistive technology with specific learning disabilities. As an independent variable, collaboration was shown to create differences in levels of expertise, frequency, and knowledge as they relate to constructs associated with assessment for computerized assistive technology with specific learning disabilities. The results of collaboration suggest that the potential for greater knowledge is there aside from how that knowledge and expertise is obtained. Further, the benefits of collaboration can occur when there is a common language between collaborators.

The differences in knowledge between professional groupings for specific learning disabilities and the results on collaboration also suggest that research in explanatory models is needed. The results of collaboration show that, collectively, assistive technology professionals have much to learn. The fact that differences existed among the professional groups shows a greater common language needs to be developed and explanatory models considered.

The decision-making process during the consideration phase is still elusive and lacks rationale for consideration before device trials begin. Thus, consideration should be given to whether focusing on particular cognitive processing deficits correlates with greater expertise of assistive technology practitioners or greater outcomes among individuals with specific learning disabilities. Determining this correlation would create a stronger rationale for consideration decisions. Currently, device trials use baseline and outcome data to make comparisons.

Because of the heterogeneity of the population, another option for grouping participants for research may need to be considered. Rather than collectively grouping based on the identification of specific learning disabilities or academic achievement areas, participants could be described in terms of cognitive processing deficits. Broad grouping based solely on academic achievement may interfere with the ability to correlate computerized assistive technology devices with outcomes properly. This limitation may hinder computerized assistive technology devices becoming evidence based practices. Explanatory models that do not use theories such as CHC and explanations in terms of broad and narrow abilities many not provide adequate evidence for the successes or failures of assistive technology devices.

This study demonstrated that collaboration contributed to greater knowledge, expertise, and frequency of consideration. Based on these findings, it is suggested that predictive studies continue so assistive technology providers are better able to understand to what degree knowledge in disabilities impacts expertise in assessment practices. Furthermore, it was questioned whether frequency of consideration influenced expertise. The study created a foundation for discussion by showing that differences do exist.

Limitations

The study was delimited in terms of its narrow scope, criteria for grouping respondents, and methodology of study. To begin, the review of literature focused on broad issues associated with assistive technology, disability research, and conclusions were drawn based on that research. Newly developed quality indicators for special education research (Odom et al., 2005) and computerized technology innovations since 1990 created a need to narrow the focus from assistive technology to computerized assistive technology devices. Research to determine evidence based practices appears slower emerging for specific learning disabilities in comparison to other disabilities such as autism, hence the need for a broader literature review to apply to a narrow focus of study.

The study was also limited in terms of participant criteria. As in other quantitative research designs, generalizability is significantly influenced by the size and representativeness of the sample. Respondents were grouped into similar professional groupings as documented in an IEP. Of the 80 respondents, 51 met the criteria for study.

The methodology of the research design relied on self-report in the form of a survey. This involved a number of limitations. First, self-reporting can result in a positivity bias among participants (Groves et al., 2012). Second, while the instrument used for the study had construct and face validity, it lacked concurrent validity because, after the review of literature, an instrument used for measurement was not found. Third, use of the Likert scale also has limitations. The answerable questions required close-ended responses; therefore, there was no opportunity for participants to explain or elaborate on their responses. Although the instrument was changed from a 5-point to a 4-point Likert Scale to reduce central tendency bias (Sclove, 2001), bias of self-reporting remained a limitation.

Conclusions

The consideration practices for computerized assistive technology devices when paired with specific learning disabilities were described. Most significant in the study was the influence of collaboration on assessment practices in terms of knowledge, expertise, and frequency of consideration for computerized devices for specific learning disabilities. It bears noting that, while gaps in knowledge and expertise exist among professionals in this area, collaboration is the key to fill gaps and grow expertise. This study compared current expertise in the area of computerized technology in relation to specific learning disabilities. Collaboration was shown to be an increasing determinant in greater outcomes across all constructs. Further research is warranted regarding correlations between the self-reported expertise in computerized assistive technology for learning disabilities and the frequency of its consideration. This study provided an appropriate foundation for future research in an evolving area.

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APPENDIX A

IRB Approval Letter

TWU
TEXAS WOMAN'S UNIVERSITY
DENTON DALLAS HOUSTON

Institutional Review Board
Office of Research and Sponsored Programs
P.O. Box 425619, Denton, TX 76204-5619
940-898-3378 FAX 940-898-4416
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April 3, 2013

Ms. Lisa Anne Thompson
1908 Cotton Mill Drive
McKinney, TX 75070

Dear Ms. Thompson:

Re: Assistive Technology Evaluation Expertise When Matching High Technology Devices for Students Identified with Specific Learning Disabilities (Protocol #: 17278)

The above referenced study has been reviewed by the TWU Institutional Review Board (IRB) and was determined to be exempt from further review.

If applicable, agency approval letters must be submitted to the IRB upon receipt PRIOR to any data collection at that agency. Because a signed consent form is not required for exempt studies, the filing of signatures of participants with the TWU IRB is not necessary.

Any modifications to this study must be submitted for review to the IRB using the Modification Request Form. Additionally, the IRB must be notified immediately of any unanticipated incidents. If you have any questions, please contact the TWU IRB.

Sincerely,

Rhonda R Buckley

Dr. Rhonda Buckley, Chair
Institutional Review Board - Denton

cc. Dr. Jane Pemberton, Department of Teacher Education
Dr. Heather Haynes, Department of Teacher Education
Graduate School