Effects of a Multimedia Shared Story on Comprehension of an Employee Handbook

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EFFECTS OF A MULTIMEDIA SHARED STORY ON COMPREHENSION OF AN EMPLOYEE HANDBOOK

By

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A dissertation submitted in partial fulfillment of the requirements for the

Doctor of Philosophy – Special Education

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entitled

Effects of a Multimedia Shared Story on Comprehension of an Employee Handbook

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ABSTRACT

Effects of a Multimedia Shared Story on Comprehension of an Employee Handbook

by

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Employment outcomes for individuals with intellectual disability (ID) continue to be among the lowest reported (Migliore, Butterworth, & Hart, 2009; Siperstein, Parker, & Drascher, 2013). Literacy skills are critical for obtaining employment and for supporting continued success in the workplace (Conceição, 2016), but individuals with ID typically have very low literacy levels (Katims, 2000). Limited research has been conducted on literacy skill development for young adults with ID, particularly on work-related texts such as employee handbooks. Research supports the use of shared stories on adapted age-appropriate texts for students with significant cognitive disabilities, including those with ID (Hudson & Test, 2011; Shurr & Taber-Doughty, 2012; Spooner, Kemp-Inman, Ahlgrim-Delzell, Wood, & Davis, 2015), but these studies primarily focused on elementary or middle school students. Very little research on shared stories has been conducted with older students with ID (ages 18 and up). These students may have access to functional academic instruction, such as accessing real-world texts, within high school, vocational programs, and postsecondary education programs found in colleges and universities. Participation in university-based postsecondary education programs for young adults with ID have demonstrated improved competitive employment outcomes for this population, with 82% of the students working jobs that paid at or above minimum wage (Grigal & Hart, 2013). Functional academic instruction, such as literacy skill development, within these programs has successfully
included the incorporation of technology to access or supplement the intervention (Evmenova, Behrmann, Mastropieri, Baker, & Graff, 2011; McMahon, Cihak, Wright, & Bell, 2016). The purpose of this study was to examine the effects of a multimedia shared story using speech-to-text technology on the text comprehension skills of college students with ID. This intervention included the use of systematic instruction to provide error correction instruction for correctly answering comprehension questions about the text of an adapted employee handbook. This study used a multiple probe across participants design to measure the effectiveness of the intervention across three sections of the employee handbook as well as demonstration of three performance tasks related to the readings. This research seeks to extend the literature by investigating the effects of this literacy treatment package on the participants’ comprehension of the text and their ability to transfer that knowledge into a practical demonstration of related work tasks. Results indicated that three of the four participants improved in their overall correct responses to the multiple-choice questions and were able to maintain their levels of response during maintenance. One participant did not have a significant change in number of correct responses. Two of the participants were able to generalize the Safety Skills performance task. One participant generalized the intercom task. Most of the steps of the handwashing task were generalized by all three participants, but they never successfully completed one of the steps in this task. The participants, program director, and potential employer all found the intervention to be effective and relevant for the participants.
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DEDICATION

This dissertation is dedicated to several people who were instrumental in my success.

First, to my incredible husband, Don, and children, Pryor, Gabby, and Nate, whose continued support, cheerleading, and sacrifice allowed me to follow my dreams. Second, to my parents (Ed and Anita), sisters (Erica and Jen), brother-in-law (Russ), and friends who became family (Rob and Brenda Zahn), who always gave me the push and the love I needed to persist in this journey. You are all an inspiration to me.
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CHAPTER ONE: INTRODUCTION

Individuals with disabilities continue to have poor postsecondary outcomes, especially regarding employment and independence (Thoma et al., 2011; Wagner, Newman, Cameto, Garza, & Levine, 2005). For example, unemployment rates for those with disabilities are currently 10.4% compared to 4.3% for those without disabilities (U.S. Office of Disability Employment, 2017). Unemployment and underemployment rates are even higher for those with an intellectual disability (ID). Employment outcomes for individuals with ID are among the lowest reported (Migliore, Butterworth, & Hart, 2009; Siperstein, Parker, & Drascher, 2013). The Family and Individual Needs for Disability Supports (FINDS) survey conducted by The Arc in 2011 found that 85% of people with ID were not working. If individuals with ID are employed, they frequently earn less money, have lower skill jobs, have higher poverty rates, and earn fewer employee benefits (Stodden & Dowrick, 2000; U.S. Senate Committee for Health, Education, Labor and Pensions, 2011; Wagner, Cameto, & Newman, 2003; Wagner et al., 2005).

Butterworth et al. (2013) report that 81% of individuals with ID were being served in facility-based settings such as sheltered workshops or nonwork settings, resulting in a lack of community inclusion and opportunity to achieve higher levels of education and employment. These low rates of employment lead to a significant reliance on government supports to survive, rather than having an opportunity to contribute to the community via increased tax revenue and reduced need for Social Security Insurance and Medicaid supports (President’s Committee for People with Intellectual Disabilities, 2011). Without an increased focus on improving opportunities and skill development for employment success, such as workplace literacy training, these unfortunate postsecondary outcomes for individuals with ID will continue.
Workplace literacy is an essential skill for successful employment (Conceição, 2016). According to Katims (2000), only 17.7% of individuals with ID reach minimal literacy levels (e.g., second grade reading comprehension), so access to informational text is often a huge barrier. Workplace informational texts, such as employee handbooks, contain essential policies and procedures for a business (U.S. Small Business Administration, n.d.). If employees do not follow these important policies and procedures, they are in danger of a lack of access to learning the required skills of a job and therefore losing the job (Inc., n.d.; National Federation of Independent Business, n.d.). Because young adults with ID generally have low literacy skills, they are at a much higher risk for misunderstanding or lacking awareness of the expectations listed within an employee manual or handbook. Further training in workplace literacy and provision of more accessible texts are needed for young adults with ID to improve their chances of employment success.

Incorporating successful instructional strategies to improve the functional literacy skills of young adults with ID may provide greater access to important texts such as employee handbooks. Systematic instruction and shared stories instructional strategies have been used to increase correct responses to comprehension questions and increase engagement with texts for students with moderate to severe ID (Browder, Lee, & Mims, 2011). Systematic instruction that includes re-reading strategies have improved the comprehension and fluency of adapted texts for college students with autism and mild to moderate ID (Hua, Hendrickson, et al., 2012).

The literature also supports the use of technology to provide instruction for individuals with ID. In literature reviews on the use of mobile technology such as iPods® and iPads® in instruction for individuals with developmental disabilities, Kagohara et al. (2013) and Mechling (2011) found that the use of these mobile technology devices were effective in increasing skills
in multiple areas, including academic, communication, employment, leisure, and transitioning skills. Many other studies have also examined the use of technology to improve the literacy skills of students with moderate to severe ID. For example, Evmenova and Behrman (2014) used technology via video adaptations and alternative narration and text captions to improve the comprehension of six college students with ID. Rivera, Mason, Moser, and Ahlgrim-Delzell (2014) combined the use of mobile technology and shared stories to increase vocabulary acquisition for an elementary student with moderate ID. Spooner, Ahlgrim-Delzell, Wood, and Ley Davis (2015) also used an iPad® to display an adapted storybook and increase text comprehension of five elementary students with moderate to severe ID. By incorporating the adapted text into an iPad®, students were able to build their skills in independently accessing the text on the device as well as improve their understanding of the story. It is clear that research supporting functional academic skills instruction exists, but it is limited on teaching literacy skills to young adults with ID, particularly for those participating in postsecondary education programs on university campuses.

**Postsecondary Education Programs**

In 2014, the Workforce Innovation Opportunity Act (WIOA), which replaced the Workforce Investment Act of 1998 and reauthorized the Rehabilitation Act of 1973, was signed into law. One of the most important components of WIOA (2014) is the emphasis placed on competitive integrated employment for all. This means that all persons, with or without disabilities, should have the opportunity to work in inclusive employment settings and earn a competitive wage. As part of this initiative, state vocational rehabilitation programs were tasked with using 15% of their federal monies to help prepare youth with disabilities to transition successfully from public school special education services to postsecondary success. This
includes assisting youth with ID and other disabilities to enroll in and complete a variety of
postsecondary education and credential programs offered through school districts, state-agency-
based job training programs, and college or university-based transition programs such as those
found through ThinkCollege!

The Higher Education Opportunity Act of 2008 provided the initial federal support
needed to begin higher education services to students with ID. In 2010, the Office of
Postsecondary Education began awarding grants to higher education institutions to fund
Transition and Postsecondary Education Programs for Students with Intellectual Disability
(TPSIDs). The goal of the TPSIDs is to help build or enhance quality inclusive higher education
programs for individuals with ID or developmental disability (Grigal & Hart, 2013). Although
funding for TPSIDs currently supports 48 programs, there are 270 programs nationwide designed
for young adults with intellectual and/or developmental disabilities (ThinkCollege.net). The
model accreditation standards of these postsecondary programs include a plan that supports
competitive integrated employment (The National Coordinating Center Accreditation
Workgroup, 2016). This aligns with the guidelines of WIOA by improving potential employment
success and independence for young adults with ID by providing continued and intensive career-
focused training (Gilson & Carter, 2016). College-based programs allow students with ID to
continue their career preparation in an age-appropriate setting, rather than continuing to attend
high school after they have reached age 18 and beyond. These programs provide person-centered
academic, employment, and social supports by aligning coursework and internship opportunities
and work experiences with the individual’s goals and interests. Year one student data summary
for the TPSIDs shows that 43% of the participating students were taking inclusive college
courses and 86% were participating in paid employment, unpaid career development
experiences, or some combination of the two (Grigal, Hart, Smith, Papay, & Domin, 2017).

Postsecondary education programs also provide exposure to the greater community by including students in a college campus social setting, and in some cases residential setting, with their typical peers. Although program types vary in their level of inclusion, all provide continued opportunities to work on employment skills, independence, and functional academics to better prepare them for employment (Moore & Schelling, 2015; Thoma et al., 2011).

Research shows that individuals with ID who participate in postsecondary education have improved chances of employment success, exceeding those who did not participate in such programs (Ross, Marcell, Williams, & Carlson, 2013; Southward & Kyzar, 2017), as well as increased self-determination outcomes (Zafft, Hart, & Zimbrich, 2004). Improvement in self-determination and self-advocacy skills can lead to greater well-being, better self-esteem, and overall greater quality of life. Along with these benefits, postsecondary education programs provide more opportunities for paid or unpaid work experiences, which is one of the highest indicators of postsecondary success for this population (Southward & Kyzar, 2017).

With reading skills significantly behind their peers (Turnbull, Zuna, Turnbull, Poston, & Summers, 2007), individuals with ID in these college programs need intensive reading instruction to meaningfully engaging in age-appropriate texts (Baker, 2008). To prepare young adults with ID within these postsecondary education programs for competitive integrated employment and to reduce barriers to workplace success, intensive literacy skills instruction is needed, especially with regards to accessing important real-world, age-appropriate texts, such employee handbooks.
Employee Handbooks

Guerin and Delp (2017) state that there are four main purposes of an employee handbook: Communication, management, planning, and legal protection. The authors further explain that a handbook should (a) tell employees about company and employee expectations and be used as a venue for communicating the company’s culture, history, and overall values; (b) be used by supervisors and managers to engage with employees following consistent and fair practices; (c) provide an opportunity to streamline company organization, particularly with policies and procedures; and (d) assist companies in complying with the law on communicating required information and reduce the risk of lawsuits. According to the U.S. Small Business Administration (n.d.), employee handbooks should be designed to protect the legal rights of employers and employees as well as provide a thorough understanding of the primary goals, mottos, procedures, and policies of a business to its employees. There are no actual federal or state laws that require employee handbooks, but there are federal and state required postings for employees.

Handbooks usually include the required postings of the U.S. Department of Labor as well as safety policies and essential procedures for the business (Inc., n.d.; National Federation of Independent Business, n.d.; U.S. Small Business Administration, n.d.). States will take those federal requirements and then add their own. For example, the U.S. Department of Labor and Nevada State Law require employers to provide proof that they communicated the following information to all employees: Rules observed by employer, notice regarding lie detector tests, information for victims of domestic violence, annual minimum wage information, and annual daily overtime information (labor.nv.gov). An employee handbook is one way of ensuring distribution of this information to all employees. Although GuideSpark, a marketing research
company, reported that up to 50% of millennials do not read their employee handbooks (www.guidespark.com), it is important for employees to understand the content of a handbook so they may understand their rights, workplace expectations, and safety procedures and precautions. Because of the challenges they have with learning new skills (Browder & Spooner, 2011), individuals with ID are already at a disadvantage in the workplace setting. Without important natural workplace supports, such as the information in an employee handbook, young adults with ID have decreased chances of workplace success.

Because handbooks contain state and federal requirements and other important policies for a workplace, they are often written using very technical and legalistic language. For example, the verbiage in the State of Nevada Employee Handbook ranks between 10th and 12th grade reading levels using the Flesch-Kincaid Grade Level assessor. A similar review of a university preschool employee handbook, placed the text at a Flesch-Kincaid Grade Level of 10.9. These high reading levels indicate a lack of accessibility for those with low literacy skills, such as individuals with ID. Lack of access to important workplace information lends itself to a higher probability of employers taking advantage of employees who are unable to understand the manuals. Employers may not hire potential employees because they cannot read or access this information independently, therefore, reducing employment options for individuals with ID.

Lack of access to the content of an employee manual could also lead to a misunderstanding of employer expectations and procedures on the job. Employees can be fired for not following policies and procedures within an employee manual (Pedersen, 2008). This indicates that a high level of importance should be placed on all employees understanding the text within an employee handbook. Because this information is considered extremely important by the employer, it should be accessible to the employee. The U.S. court system supports that
much of the text within an employee manual falls under contract law, which can deeply affect an employee’s rights to maintain and hold his or her job (Pedersen, 2008). Therefore, lack of accessible employee handbooks and low literacy skills can be considerable limitations to employment success.

**Literacy Instruction**

In 2000, the National Reading Panel (NRP) determined that reading comprehension was critical to obtaining an education and furthering academic learning. The five critical areas the panel stated were essential to developing good readers included phonemic awareness, phonics, vocabulary, fluency, and comprehension (NRP, 2000). The panel addressed several instructional strategies to support students in these five areas; however, the NRP did not focus on reading instruction for students with ID. With the passing of IDEA (1997) and No Child Left Behind Act (2001), students with ID were expected to participate in and have access to the general curriculum and schoolwide accountability assessments. This led to a rise in research on reading instruction for students with ID. Browder, Wakeman, Spooner, Ahlgrim-Delzell, and Algozzine (2006) conducted a literature review of 128 studies on reading instruction for students with significant cognitive disabilities. They compared the findings from these studies to the NRPs components of reading and found strong evidence for certain strategies for teaching sight words, comprehension, and fluency. The authors stated that more research was needed on teaching a wider array of literacy skills to students with significant cognitive disabilities.

Researchers have continued to break down the recommended components of the NRP to determine the most effective means of instruction and support for individuals with ID. The results demonstrate that if given enough time and instruction, students with ID can make progress in all five of these areas using explicit, systematic instruction. For example, Allor,
Mathes, Roberts, Cheatham, and Otaiba (2014) completed a 4-year study on the use of an evidence-based comprehensive early intervention literacy program for struggling readers to teach literacy skills to 141 students with mild to moderate ID. The program used explicit, systematic instruction to teach all five components of reading recommended by NRP (2000). Allor et al. (2014) found that those with higher IQs made gains faster than those with lower IQs, but that all students who received the intervention made marked progress in their reading skills. Students who made the lowest gains were then given additional supports, such as adapted texts and additional sight word and decoding activities. After these supports were added, these students also made progress. Beecher and Childre (2012) combined a comprehensive literacy instruction program with sign language to improve sight word knowledge, letter recognition and phonemic awareness, vocabulary, and listening comprehension of three elementary students with mild to moderate ID. All three participants improved in all areas except expressive vocabulary and reading level. Their listening comprehension gains were significant.

Comprehension is the overall goal of literacy skill development. The NRP (2000) recommends eight methods to teach comprehension to all students: (a) comprehension monitoring, (b) cooperative learning, (c) graphic and semantic organizers, (d) structured story maps, (e) question answering with immediate feedback, (f) question generation by the reader, (g) reader summaries, and (h) multiple-strategy teaching where several of these methods are combined. One method of comprehension instruction, which includes several of these recommended components, that continues to demonstrate effectiveness in teaching literacy skills and providing overall access to age-appropriate texts for students with moderate to significant cognitive disabilities is shared stories, sometimes called read alouds (Hudson & Test, 2011). Shared story interventions generally include the adaptation of grade-level or age-appropriate
texts to a lower reading level, use of pictures or objects to aid in comprehension, an embedded student interaction or engagement element, and a read aloud of the text that combines comprehension monitoring and cooperative learning. For example, Browder, Mims, Spooner, Ahlgrim-Delzell, and Lee (2008) used shared stories to build engagement and listening comprehension of three elementary students with significant cognitive disabilities. Using the principles of Universal Design for Learning (UDL), Browder et al. created an adapted text and then incorporated systematic prompting and feedback to increase the students’ independent responses to a 16-step task analysis that included answering questions about the story. Mims, Hudson, and Browder (2012) used shared story instruction on adapted grade-level biographies combined with graphic organizers to improve the comprehension skills of four middle-school students with moderate to severe ID. In this way, individuals with very low reading levels were provided access to text and comprehension opportunities that were similar to their peers while still developing and enhancing early literacy skills such as vocabulary development and appropriate interaction with a text (e.g., identifying the cover of the book, finding the author name, reading left-to-right).

Although the concept of shared stories has a moderate level of evidence supporting the practice in improving academic skills for students with ID (Hudson & Test, 2011), the key component of the most successful of these interventions in developing academic skills was the incorporation of systematic instruction (Browder et al., 2008; Hudson & Test, 2011; Mims et al., 2012), specifically listening comprehension (Mims et al., 2012) and reading comprehension (Browder, Hudson, & Wood, 2013). Much of the shared story research has focused on younger participants with significant cognitive disabilities such as elementary students (Browder, Lee, & Mims, 2011; Browder, Root, Wood, & Allison, 2015; Coyne et al., 2012; Spooner, Ahlgrim-
Delzell, Wood, & Ley Davis, 2015) and some middle school students (Mims et al., 2012; Shurr & Taber-Doughty, 2012). Very little has been published on the use of shared stories with high school or college-age students with ID. A literature review revealed an article and a dissertation using shared stories with high school students with ID. Shurr and Taber-Doughty (2017) taught four high school students with moderate ID to correctly respond to comprehension questions and perform story retells on age-appropriate texts such as newspaper articles, high-interest readings, and sections of employee handbooks using read alouds and visual supports. Kemp-Inman (2017) used shared stories, explicit instruction, graphic organizers, and a re-reading strategy to build the text comprehension skills of three high school students with moderate to severe ID. None of the studies found in the literature used shared stories for students with ID in postsecondary education programs in college settings. Additional research is needed on the use of shared stories as an instructional strategy to improve the literacy skills of young adults with ID.

**Handheld or Mobile Technology**

By applying the principles of UDL and multimedia learning (Meyer, 2009) through handheld electronic devices, real-world texts are easily adapted to provide effective systematic instruction. Mobile technology, which includes smartphones and tablets (e.g., iPads®), is a vital part of the American culture (Chan, Walker, & Gleaves, 2015). The widespread availability of this technology provides new opportunities to independently access previously inaccessible text through built-in features such as text-to-speech functions, video or picture availability, and much more. Many accessibility tools come as standard features built into personal electronic devices such as smartphones, tablets, and laptops (Apple.com). Text-to-speech and speech-to-text, although not perfect, greatly improve communication possibilities and read-aloud features for anything on the device’s screen. Video or pictures may easily be added or are already used as
navigation or communication tools on these devices. Settings can be adjusted to provide larger text, louder sound, help with touch screen access, and so much more.

Portable electronic devices, such as tablets and smartphones, offer individuals with disabilities increasing opportunities for independence through their flexibility (Kagohara et al., 2013; Mechling, 2007, 2011; Wehmeyer, Palmer, Smith, Davies, & Stock, 2008). For example, word prediction and text-to-speech capabilities available in smartphone texting and note-taking apps, have been found to increase the writing skills of secondary students with learning disabilities and students from culturally and linguistically diverse backgrounds (Silió & Barbetta, 2010). Speech-to-text recognition has helped with understanding learning content of a lecture, providing or confirming missed parts of a lecture and enhancing notes, improving reading comprehension, and helping students prepare for exams (Elkind, Black, & Murray, 1996; Shadiev, Hwang, Chen, & Huang, 2014).

Mobile learning interventions have been used successfully to improve math skills and create interactive environments where teachers can provide immediate corrective feedback to students (Enriquez, 2010; Kiger, Herro, & Prunty, 2012). Low-level language skills can be supported using technology inside and outside the classroom as well (Lai, 2014). An advantage to that portability is that students with reading and writing concerns can take their devices out into the world and continue their learning by recording and documenting information and sharing it with others without having to read and write everything themselves, thereby supporting educational independence (Swan, Kratcoski, & van’t Hooft, 2007). Teaching students with disabilities how to perform these tasks on familiar devices makes the learning easily transferrable to other environments and tasks as needed (Armstrong, Gentry, & Wehman, 2013).
Increased access to portable technology or personal electronic devices has made the process and display of text adaptation, a key component of shared story interventions, even easier for teachers and interventionists. With the increased availability of tablet technology (e.g., iPads®), teachers are able to apply the principles of UDL to adapted grade-level texts with greater ease. Several studies have combined the use of portable technology with adapted shared stories to deliver literacy instruction in an engaging way for students with ID that supports their interaction with the text. Rivera, Mason, Moser, and Ahlgrim-Delzell (2014) created an individualized story for a 10-year-old student who was learning English and had a moderate ID to improve vocabulary in both English and Spanish. Within this iBook™, the researchers embedded pictures of items the student was not able to identify in either language. Over the course of the study, the student acquired the vocabulary words in both languages through the shared story intervention. Rivera, Spooner, Wood, and Hicks (2013) also used multimedia shared stories and constant time delay to improve the vocabulary acquisition skills of two elementary-aged English language learners with moderate ID. The personalized texts were created and displayed on a laptop using PowerPoint slides. Within these texts, written in both English and Spanish, sound effects and pictures for the vocabulary words were embedded to increase engagement with the text. Both participants increased in their vocabulary knowledge, and one student demonstrated a significant increase.

Interactive games and supporting e-texts were used by Coyne, Pisha, Dalton, Zeph, and Smith (2012) with great success as well. Coyne et al. examined the use of a UDL-based approach to literacy instruction for elementary students with significant ID. This approach included scaffolded e-books and interactive games to significantly improve the passage comprehension abilities of the participants. Spooner, Kemp-Inman, et al. (2015) used multiple-exemplar training
and shared stories on an iPad® to assess the generalizability of early literacy skills to five elementary students with severe cognitive disability. The researchers adapted a grade-level storybook and displayed the text on an iPad®. They then assessed the students on their independent responses to steps in a literacy skill-based task analysis (e.g., identify the book title, turn the page, etc.) and responses to listening comprehension questions. Additional tools incorporated in this instruction included a modified system of least-to-most prompts, a re-reading strategy, and the use of text-to-speech to conduct the read aloud. A significant increase in correct responses to the task analysis was found for all participants. Of the five participants, four significantly increased their correct responses to the comprehension questions and one made moderate improvement. These successful interventions included an adapted text displayed on an iPad® or laptop, accompanied by supporting pictures embedded on the screen. Armstrong (2010) also demonstrated some support for the use of computer-aided read alouds for the listening comprehension skills of children with autism. Her research compared the results of a person reading the text aloud to the computer reading the text. Neither version demonstrated more effect than the other, thus supporting the use of text-to-speech as a tool to use for the increased independence of the reader.

The potential for increasing independence for individuals with ID is an important consideration of mobile technology. Uploading video modeling sequences, picture checklists, and/or overall task lists and reminders into an individual’s personal electronic device allows him or her to go about the employment day or independent living task without a supervisor constantly looking over his or her shoulder (Mechling, 2007; Wehmeyer et al., 2008). If a person needs to see something demonstrated again, he or she can listen to the text, play back the video, or go over the picture checklist as many times as needed. Incorporating these tools in skill instruction
may therefore improve access to employment opportunities as well as living an independent and higher quality life.

**Statement of the Problem**

Limited literacy skills can lead to a lower quality of life (Bradford, Shippen, Alberto, Houchins, & Flores, 2006). Individuals need literacy skills to access new knowledge, which leads to higher levels of independence and choice making (Houston & Torgerson, 2004). For individuals with ID, having inadequate understanding and access to text can lead to reduced levels of independence; therefore, building higher levels of text comprehension is essential for academic success and ideal independent functioning (Wahlberg, & Magliano, 2004). Lower levels of basic literacy skills, for which individuals with ID are known to be at risk (Kaiser, Hester, & McDuffie, 2001), lead to restricted access to and understanding of important functional texts such as employee handbooks. Because employee handbooks hold essential procedural, safety, and overall employment policies, a lack of understanding of these workplace texts potentially affects access to employment as well as the overall employment success of young adults with ID.

The purpose of this study was to examine the effects of a multimedia adapted employee handbook using speech-to-text technology on the text comprehension skills of college students with ID. The treatment package included the use of three of the eight NRP (2000) recommended methods to teach comprehension to all students: (a) comprehension monitoring, (b) graphic organizer, and (c) question answering with immediate feedback. This study also examined the effect of the multimedia shared story on the participants’ abilities to demonstrate an employment task related to what they read in the handbook. This study addressed the following questions:
1. Does the application of a multimedia literacy treatment package improve the text comprehension of an adapted employee handbook for college students with ID?

2. Does the application of a multimedia literacy treatment package, using an adapted employee handbook, improve the completion of employment tasks discussed in the text?

3. Was the multimedia literacy treatment package and adapted employee handbook considered an effective method for increasing understanding of important employee concepts by the students, the program director, and the employer?

**Significance of the Study**

This study is important because it expands the current research base on individuals with ID in several key areas: literacy skill instruction, postsecondary education programs, employment success and access, and use of portable technology. The results of this study expand the research on literacy skill instruction for individuals with ID, particularly in shared stories. Shared story or read-aloud interventions using age-appropriate adapted texts have primarily focused on elementary and middle-school aged students. This research expands shared stories to college-age students with significant cognitive disabilities participating in postsecondary education programs.

Postsecondary education programs are tasked with providing education and training in employment and independent living skills (ThinkCollege.net). Previous academic interventions within this population include very little about text comprehension improvement. This study adds to the current research on academic interventions provided in postsecondary education programs by incorporating a multimedia shared story intervention to improve the text comprehension of an age-appropriate, workplace text.
Previous research on developing workplace skills for young adults with ID has not focused on text comprehension or workplace texts. Very little research on the comprehension of employee handbooks has been done for this historically underserved and underemployed population. This study expands the research base on workplace skill development by focusing on the adaptation and comprehension of an employee handbook to improve access to key workplace policies and procedures for young adults with ID.

Finally, the rapid advancement of handheld or mobile technology provides ample opportunity for improvements to the independence of individuals with moderate to significant ID. Because technology changes so quickly, continued research is needed to support incorporating implementation of evidence-based practices using these devices to provide flexibility of use. By focusing on the use of standard issue accessibility tools on popular handheld technology with young adults with ID, this study extends the previous research on text comprehension instruction for students with moderate to significant ID. The current study provides continued support for the importance of access to age-appropriate texts for individuals with significant cognitive disabilities.

**Delimitations**

The following are the delimitations of this study. The boundaries were set during conceptualization of the study and provided a framework for this research. First, only a small, convenience sample was used. Because the focus of this study was on postsecondary education program interventions, which follow person-centered planning procedures, potential student participants that fit into the selection criteria were limited. Next, the handbook text may be viewed by some as a nonessential text. However, this text was adapted with the significant cooperation of the employer (i.e., the university preschool director). The employee handbook
contained what the employer determined to be essential policies, procedures, and workplace culture, particularly about the types of internship opportunities that students in this postsecondary education program have in the university preschool setting. The comprehension measure included a selection of four multiple-choice responses with accompanying pictures that may increase chances for correct responses. However, three versions of each handbook section were created where the order of questions and answers were varied. The version used for each intervention session was then randomly selected to reduce potential order memorization. Another delimitation was that the researcher was also one of the instructors, which may introduce bias into the study results. To counter this, procedural fidelity and interrater reliability were collected throughout all phases of the study. Finally, with any intervention involving technology, technological issues and errors may occur. Care was taken throughout the study to maintain procedural fidelity despite any technological concerns. These events also provided naturalistic opportunities to teach additional technology-based problem-solving skills to the participants.

**Definition of Terms**

The following definitions include a list of terms used throughout this study.

**Adapted texts.** A summary version of a text usually accompanied by picture symbols used to support key vocabulary, elements, or ideas in the text (Browder, Spooner, & Zakas, 2011).

**Alternative narration.** Narrative text that was altered from the original state to the level of the reader, which in this case was someone with an ID (Evmenova, Behrmann, Mastroiopier, Baker, & Graff, 2011).
Augmented reality. The use of digital information within a physical world (McMahon, Cihak, & Wright, 2015). For example, the use of a navigation application on a smartphone that displays your current location on a digital map.

Constant time delay. A prompting system used to encourage errorless learning, the instructor provides several rounds of instruction with no time delay in error correction or prompting and then the instructor moves to a specific delay time (e.g., 5 seconds) between presentation of a stimulus and when the instructor will respond with a block and a redirect for incorrect or no responses (Spooner, Browder, & Mims, 2011).

Competitive integrated employment. Employment within a typical, inclusive setting alongside individuals without disabilities and includes the opportunity to earn a competitive wage (Gamel-McCormick, 2016).

Decoding. Includes the aspects of phonological awareness, phonics, and word recognition. Decoding skills are needed to make sense of text (NRP, 2000). The reader must be able to translate the written symbols.

Extraneous cognitive processing. Cognitive processing that does not serve the instructional goal and is generally caused by poor instructional planning (Mayer, 2009).

Fluency. The ability to recognize and read words with automaticity and accuracy (NRP, 2000).

Fostering generative processing. An element of instructional design that includes developing and enhancing deep cognitive processing that includes organizing and then integrating information (Mayer, 2009).
**Functional academics.** Method of academic instruction that includes real-world based application of academic skills. For example, teaching math through money or time management (Browder, Spooner, & Trela, 2011).

**General case programming.** An instructional strategy that focuses on operationally defining the instructional universe and the range of stimulus and response variations within it. This process uses specifically selected and sequenced teaching examples and plans and tests for generalization of responses (Horner, Sprague, & Wilcox, 1982).

**Intellectual disability.** A disability that originates before age 18 that significantly limits intellectual functioning as well as adaptive behavior over a variety of common social and practical skills (American Association on Intellectual and Developmental Disabilities, 2017).

**Least-to-most prompting.** A hierarchical system of prompting that provides levels of prompts as needed, beginning with the least intrusive (e.g., verbal or gestural) to most intrusive (e.g., hand-over-hand, physical guidance) (Spoon et al., 2011).

**Literacy.** The ability to read text to acquire meaning and write text to communicate meaning (Katims, 2000).

**Managing essential processing.** An element of instructional design that includes managing the complexity of material to appropriately process the material into working memory (Mayer, 2009).

**Multimedia learning.** A system of learning that allows the learner to construct mental representations of a concept from words and pictures (Mayer, 2005).

**Multimedia instruction.** A system of instruction that uses the presentation of words and pictures to promote learning (Mayer, 2005).
**Personal electronic devices (PEDs).** Smaller, transportable items with computer and/or internet capabilities such as smartphones, tablets (e.g., iPads®, KindleFire®), and laptop computers.

**Phonemic awareness.** The result of understanding that the spoken word can be broken down into specific, individual sounds that make up a complete word (NRP, 2000).

**Phonics.** Involves the understanding of how individual letters and combinations of letters represent specific sounds, or phonemes, in words. Phonics is the process of blending those sounds together to make various words. Phonics instructions surround the direct teaching of this skill (NRP, 2000).

**Postsecondary education program.** A college-based program designed to support individuals with significant cognitive disabilities who would otherwise not be able to attend college based on not earning a standardized high school diploma (thinkcollege.org).

**Prompting hierarchy.** Used in systematic instruction, prompting hierarchies are a plan to provide prompting as needed following a least-to-most or most-to-least intrusive prompt system (Spooner et al., 2011).

**Read aloud.** Also referred to as “shared story” and describes the reading of a text out loud to a listener by a person or type of technology (Hudson & Test, 2011).

**Reading.** The process of translating written text into meaning through an understanding of alphabetics, fluency, and comprehension (NRP, 2000).

**Reading comprehension.** When a reader creates a coherent representation of text by translating the written word into meaningful information. It is a process of decoding and comprehending text (NRP, 2000).
**Scaffolding.** When an instructor provides additional information, such as background knowledge or additional hints, so the student can come up with an appropriate answer to a question or concept (Browder, Spooner, & Meyer, 2011).

**Self-advocacy.** The ability to advocate for individual and personal wants and needs without outside assistance (Wehmeyer & Shogren, 2013).

**Shared stories.** An educational practice that provides students with significant cognitive disabilities access to age-appropriate text through a reader-listener interaction. The story is read aloud and listener interaction with the reader and the story is supported in the intervention (Hudson & Test, 2011).

**Significant cognitive disabilities.** Cognitive disabilities that are significant enough that the individual is not able to participate in regular assessments, even with accommodations and modifications, and therefore is qualified to take alternative assessments (IDEA, 1997).

**Systematic instruction.** An instructional practice based on the principles of applied behavior analysis where the instructor establishes (a) a definition of the skills to be learned, (b) clearly defined methods of instruction, (c) implementation of a systematic instructional plan, and (d) a review of the student progress data to make instructional decisions (Spooner et al., 2011).

**Task engagement.** When an individual is performing a given task as directed (Gilson & Carter, 2016).

**Text comprehension.** This is similar to reading comprehension; however, the method of text delivery could be different (e.g., read aloud; Snyder, Knight, Ayres, Mims, & Sartini, 2017).
CHAPTER TWO: REVIEW OF THE LITERATURE

Access to and comprehension of text is a fundamental skill for independence, as well as academic (Browder et al., 2009) and employment (Conceição, 2016; Vacca et al., 2012) success. Because of this, literacy skill development is a key focus of national education recommendations, including common core state standards (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010), NRP (2000), and National Institute for Literacy (2001). Research suggests that for individuals with ID to make gains in literacy skills (e.g., comprehension) and obtain access to text, specific types of instruction and adaptations need to be used, such as systematic and explicit instruction (Browder & Spooner, 2011), shared stories or read alouds (Hudson & Test, 2011), adapted text with visual supports (Browder, Wood, Thompson, & Ribuffo, 2014), and the use of technology to provide access (Kagohara et al., 2013; Rivera et al., 2014; Spooner et al., 2015).

As postsecondary outcomes are still poor for individuals with ID despite years of effective interventions (Newman et al., 2011), this type of instruction and provision of access to text is needed beyond the K-12 environment. Literacy instruction for young adults with ID at the postsecondary level is needed to improve supports and individual preparation for successful employment. This chapter will provide the literature base for this study by reviewing the research (a) supporting successful academic instruction in text comprehension, specifically shared stories; (b) incorporating the use of technology and multimedia learning for instruction; and (c) discussing the types of instruction that have taken place in postsecondary education programs for individuals with significant cognitive disabilities.
Literacy and Academic Instruction

Effective academic instruction for students with ID includes several important evidence-based practices. This section will discuss two fundamental academic instructional practices for students with moderate to significant ID: systematic instruction and self-instruction using graphic organizers. Then the overall purpose of literacy instruction, which is text comprehension, will be reviewed. Finally, the literature supporting the use of shared stories with adapted texts as a research-based practice will be discussed.

Systematic Instruction

An evidence-based practice for academic and functional skills instruction for individuals with ID is systematic instruction, which originates from the principles of applied behavior analysis (Cooper, Heron, & Heward, 2007). Systematic instruction incorporates a variety of components including task analysis, prompting systems, reinforcement, and training for generalization (Browder et al., 2014; Miller & Test, 1989). Task analysis or chaining is used to support the developed set of steps for completing a skill (Browder & Spooner, 2011). For example, Mechling, Gast, and Langone (2002) used systematic instruction via a system of least prompts and computer-based video recordings to teach generalization of grocery words to four students (ages 9 to 17) with moderate ID. They were successfully taught a task analysis for locating items in a grocery store. Spooner, Kemp-Inman, Ahlgrim-Delzell, Wood, and Davis (2015) used multiple exemplar training to teach elementary students with significant disabilities to complete a task analysis that evaluated engagement with the text as well as generalization of the skill to new texts. Prompting systems, including simultaneous prompting, graduated guidance, time delay, or system of least or most prompts, provide instructional supports and error correction procedures for building skills (Wolery, Ault, & Doyle, 1992). When using least
intrusive prompting systems, early literacy skills can be taught to individuals with moderate and severe intellectual and developmental disabilities (Browder et al., 2007, 2008; Doyle, Wolery, Ault, & Gast, 1988). Least-to-most prompting has been effective in improving listening comprehension (Mims et al., 2012; Spooner et al., 2015) and reading comprehension (Browder et al., 2013) for elementary and secondary students with significant cognitive disabilities. Reinforcement, in the form of descriptive praise, for completed steps or engagement is an essential component of applied behavior analysis and systematic instruction (Cooper et al., 2007). Effective skill building for individuals with ID has used generalization training in natural environments (Colyer & Collins, 1996; Mechling et al., 2002; Riesen, McDonnell, Johnson, Polychronis, & Jameson, 2003; Stokes & Baer, 1977) or by using multiple exemplars (Collins, 2007; Collins, Karl, Riggs, Galloway, & Hager, 2010; Mims et al., 2012; Smith, Schuster, Collins, & Kleinert, 2011).

**Graphic Organizers**

Another evidence-based instructional practice for individuals with ID and a means of building skills for independence is self-directed learning or self-instruction (Smith, Shepley, Alexander, & Ayres, 2015). In a review of the literature on self-instruction, Smith et al. (2015) found that, of the 57 participants with moderate to severe ID, 56% were able to generalize their self-instruction skills to other tasks. This study demonstrates that even those with the most significant cognitive disabilities can be taught an important skill for independence that may be applied to a variety of settings. One method of supporting self-directed learning is using a picture-based graphic organizer. Graphic organizers are a visual representation of information contained within a text (Jiang & Grabe, 2007). Mithaug and Mithaug (2003) successfully used a graphic organizer and student-directed instruction to increase self-management in four
elementary students with significant cognitive disabilities. Bethune and Wood (2013) used a graphic organizer for “Wh” questions to support the reading comprehension of three elementary students with autism. They used a least-to-most prompting system to teach the students how to use the organizer to sort vocabulary into correct categories and to answer literal recall comprehension questions about a short reading passage. All three participants significantly improved their scores in both dependent variables and were able to generalize this skill to readings with other teachers. Steed and Lutzker (1997) used picture prompts to teach an adult with ID to successfully complete vocational tasks such as dusting, setting the table, and vacuuming. The participant improved from a baseline of less than 13% steps correct to over 87% steps correct with the use of the picture prompts.

This dissertation study was a conceptual replication of Mims, Hudson et al. (2012). In the Mims, Hudson et al. study, the researchers used a picture-based graphic organizer to support the understanding of “wh” questions when assessing comprehension of grade-level biographies for four middle schoolers with moderate to severe ID and autism. The researchers used systematic instruction and a least-to-most prompting hierarchy to teach participants how to use the organizer to answer comprehension questions based on the text. All four students made progress in their correct responses during intervention compared to baseline.

**Text Comprehension**

Comprehension is the chief purpose of reading. Effective readers think about what they are reading and pay attention to the message in the text (Harvey & Goudvis, 2000; Snow, 2002). Comprehension of the text comes from the deep thinking that strong readers engage in while reading (Pressley & Afflerbach, 1995). Literacy instruction for students with ID has typically focused on beginning literacy skills such as decoding and sight word recognition (Browder &
Spooner, 2011). Because students with ID typically take much longer to develop literacy skills such as decoding (Allor et al., 2014), they learn to read at a much slower pace. However, having decoding skills does not automatically equal understanding of text (Donin, 2004), so solely teaching or waiting for decoding to be perfected before trying to teach comprehension skills puts many students with ID at a disadvantage. By trying to teach decoding to mastery before moving on to comprehension, students with ID have had to wait too long to take part in the comprehension of age-appropriate text.

The challenge remains that students with ID struggle with working memory (Henry & Winfield, 2010), which can make comprehension over the course of a text difficult. Individuals with ID also generally have difficulty making inferences and may struggle to demonstrate understanding because of a variety of factors, such as communication deficits (Kluth & Chandler-Olcott, 2008). Several methods have been found to be effective in building comprehension skills for students with ID. These include modifications to the age-appropriate text (Browder et al., 2007), shared story/read-aloud (Hudson & Test, 2011), self-monitoring of comprehension strategies (Hudson & Test, 2011; Whalon & Hanline, 2008), the use of think alouds while reading to students (Harvey & Goudvis, 2007; Doğanay Bilgi & Özmen, 2008), reciprocal teaching (Lundberg & Reichenberg, 2013; Palincsar & Brown, 1984), explicit and systematic instruction, including pre-teaching vocabulary (Knight, Spooner, Browder, & Wood, 2013), and using visuals and examples versus nonexamples coupled with graphic organizers (Mims, Hudson et al., 2012). Because literacy instruction includes such a broad range of areas, this dissertation will focus in on the use of shared stories in adapted texts to improve the comprehension of individuals with ID.
Shared Stories With Adapted Texts

Shared stories or reading is a broad term used to describe adults reading aloud to children and combining that with opportunities for discussion or questioning of the text context (Fisher et al., 2008). Because it is a read aloud of the text, students of all ages can be exposed to age-appropriate literature even if they do not have the prerequisite literacy skills to read the text independently. Shared reading combined with discussion, repeated readings, and engaging books have been found to increase the literacy skills of typically developing students (Coyne et al., 2004), students with mild to moderate disabilities (Davie & Kemp, 2002), and students with significant disabilities (Hudson & Test, 2011).

To obtain a comprehensive outlook on effective practices in building individual text comprehension using shared stories and adapted texts, a systematic review of the literature was conducted. In 2011, Hudson and Test performed a systematic review of the literature regarding shared stories for students with extensive support needs. Their review included peer-reviewed studies or dissertations that used an experimental design, included participants with significant disabilities (e.g., ID, autism, multiple disabilities), had shared story reading as the independent variable, and measured literacy in some way (e.g., listening comprehension, vocabulary). They purposefully used a broad definition of literacy, including “access to age appropriate literature,” to include studies for those with significant disabilities. They then evaluated the studies they found for quality of the study and the level of evidence to support the practice. To evaluate quality of the study, Hudson and Test used Horner et al.’s (2005) quality indicators for single-case design studies, which included sufficient description of participants, setting, dependent and independent variables, procedures, results, and social validity. After their review of the studies, a total of six met the inclusion criteria. None met all the quality indicators from Horner et al.
(2005); however, they all met 19 of the 20 indicators. Hudson and Test (2011) then reviewed these six studies for level of evidence to support the practice of shared story instruction for this population. They determined that the studies met the qualifications of moderate level of support for shared stories. This includes at least three high-quality or acceptable studies (i.e., they meet most of the quality indicators), reflect results from one to two independent research teams, and demonstrate a functional relationship.

This subsequent review follows Hudson and Test’s (2011) methodology but extends the literature from 2009 until 2017. The following EBSCOhost search engines and databases were used for the search: Academic Search Premier, ERIC, MasterFILE Premier, PsycINFO, PsycARTICLES, Middle Search Plus, Health Source: Nursing/Academic Edition, and CINAHL With Full Text. Sage Journals Online was also explored. A combination of the following search terms was used in all engines: shared story reading, read alouds, literacy-based lesson, intellectual disability, special education, storybook reading, story-based lesson, extensive support needs, and developmental disability. The search was limited to the years 2009 to 2017, extending Hudson and Test’s (2011) review. Inclusion criteria were that (a) the article or dissertation was written in English; (b) was peer-reviewed; (c) discussed an experimental study; (d) included participants with intellectual disability, autism, or multiple disabilities; (e) included an intervention with shared story or read aloud as a component; and (f) the dependent variable included a measure of literacy (e.g., comprehension questions, vocabulary). Initially, 2,898 articles or dissertations resulted from the search. After a review of abstracts, this was reduced to 59 articles. These 59 articles were then reviewed for quality indicators recommended by Hudson and Test (2011) and the inclusion criteria, which further reduced the number of articles included to 17. The details of these 17 studies are laid out in Table 1.
Table 1

Summary of Shared Stories Literature

<table>
<thead>
<tr>
<th>Study / design</th>
<th>Independent variables</th>
<th>Dependent variables</th>
<th>Participants</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armstrong (2010)*</td>
<td>Repeated readings of: *Adapted storybooks displayed on computer with highlighting software and text-to-speech (Intervention 1) *Adapted hardcopy storybooks read aloud by the researcher (Intervention II)</td>
<td>20-question quiz after every story: 10 “wh” questions and 10 inferential or prediction questions. Story retellings guides based on Morrow’s (1985) retelling scale were scored to assess listening comprehension.</td>
<td>Five elementary students, ages 7 and 8 years</td>
<td>A total of three, all had highest working memory indices, of the five children improved in their listening comprehension during intervention, but two did not do any better than baseline. The retelling scores remained low for all children, albeit slightly higher for two of the higher scoring listening comprehension children.</td>
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<tr>
<td>Browder, Lee, &amp; Mims (2011)</td>
<td>Adapted text, systematic instruction with scripted lesson and prompting hierarchy (student was prompted to re-read and reread/answer the question if incorrect), included ideas for presenting the materials creatively (e.g., using a fan to blow across a student’s face to represent wind), praise for</td>
<td>Number of independent responses to 17-step storybook reading task analysis that included engagement and comprehension components (e.g., Interact with Anticipatory Set = Engagement 10; Comprehension questions = 7)</td>
<td>Three elementary students ages 6, 8, and 9, with severe ID and physical or sensory impairments</td>
<td>All three students increased in their level of responses to the comprehension and engagement measures. Teachers reported that the intervention was effective, and they would use it again in class. Students maintained their higher levels of achievement with only a slight decrease in level in the maintenance phase.</td>
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</table>
**Browder, Root, Wood, & Allison (2015)**

Multiple-probe across participants design

- Use of systematic instruction and computer-aided instruction, which incorporated constant time delay, modified system of least prompts, read aloud, and self-completed story map.
- Number of correct independent word definitions and story elements pairings, labelling of an electronic story map, and comprehension of stories.
- Three elementary students, ages 8, 9, and 10, with autism, verbal, and participated in alternate assessments.

**Coyne, Pisha, Dalton, Zeph, & Smith (2012)**

Group design with pretest / posttest: Five intervention and four control

- *Comprehensive curriculum – Literacy by Design*
- *Four digital storybooks with embedded supports for comprehension, vocabulary, phonics, and fluency*
- *Supporting e-books*
- *Interactive games/ exercises software*
- *20 to 30 minutes per day of reading instruction supported by the software*
- *Reading growth, including letter-word identification, understanding directions, passage comprehension, word attack, picture vocabulary, oral comprehension, and sound awareness*
- *Letter identification*
- *Concepts about print*
- 16 elementary students, ages 5 to 9, with multiple disabilities, developmental disability, autism, and various genetic disorders.

**Edmister & Wegner (2015)**

Multiple baseline

- *Repeated read alouds of shared stories while using augmentative and alternative*
- Number of conversational turns taken using communication devices compared based on number.
- Three elementary students, ages 7 to 9. Cerebral Palsy and Microcephalia.

**Students improved in all three dependent variables and were able to maintain those higher levels of performance.**

**Passage comprehension demonstrated a statistically significant effect in favor of the intervention. Passage comprehension, word attack, listening comprehension, and concepts about print all had an effect size of close to or slightly above 1.**
<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Participants</th>
<th>Intervention Phase</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Golloher (2016)*</td>
<td>Multiple baseline across</td>
<td>Three preschool students ages 4 and 5.</td>
<td>All used communication devices.</td>
<td>Demonstrated a decreasing trend in intervention. Two participants demonstrated a steady upward trend toward mastery, which was maintained during generalization. The other showed an immediate increase in level to 100% mastery.</td>
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<td></td>
<td>baseline across participants</td>
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<td></td>
<td>*adapted shared storybook program based on Universal Design for Learning (UDL) principles, <em>Pathways to Literacy.</em> -Includes prompting strategy, real objects, AAC device, task analyses</td>
<td>Percentage of steps correct in a 23-step task analysis that measured: Engagement in reading, listening comprehension and communication responses.</td>
<td>Three preschool students ages 4 and 5.</td>
<td>Visual impairments and autism.</td>
</tr>
<tr>
<td>Hudson (2013)*</td>
<td>Multiple probe across participants</td>
<td>Three elementary students ages 9 to 11 with moderate ID</td>
<td>Number of unmodeled correct responses after hearing the adapted text (could include re-reads), number of correct responses after hearing the text once, and number of correct responses to comprehension question on a different peer-read chapter</td>
<td>All three students showed significant improvement in the number of comprehension responses based on verbal prompting to reread, but no modeled prompting. One student demonstrated a significant increase in completely unprompted correct responses. The other two showed a slight upward trend. Two of the three increased in correct generalized responses.</td>
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<td>Shared story package with system of least prompts and peer delivery, rules for answering wh-questions, listening again opportunities, self-monitoring</td>
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<tr>
<td>Kemp-Inman (2017)*</td>
<td>Treatment package including preteaching using sequencing graphic organizer</td>
<td>Three high school students, ages 16, 17, and 18.</td>
<td>* Correct responses on comprehension questions.</td>
<td>All three participants improved in the number of correct comprehension questions during</td>
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<tr>
<td>Study</td>
<td>Intervention Details</td>
<td>Outcomes</td>
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<tr>
<td>Multiple probe across participants</td>
<td>with pictures, system of least prompts and model-lead-test were used for explicit instruction, adapted text, verbal praise, re-reading strategy, book club discussion group with peers.</td>
<td>* Generalization to comprehension questions in the book club setting. * Response to higher order discussion questions. * Peer contributions to discussion questions. Moderate or severe ID intervention and their responses during the book club discussions. All three participants and the peer participants improved in their discussion contribution performance during book club.</td>
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<tr>
<td>Mims, Hudson, &amp; Browder (2012)</td>
<td>Modified system of least intrusive prompts, adapted text (biographies), read aloud, and sequencing and “wh” question graphic organizers.</td>
<td>Number of correct unprompted responses to listening comprehension questions. Four middle-school students, ages 12, 13, and 14. Autism and severe ID. All four participants significantly improved in their number of correct question responses during intervention. One student even started reading the texts and questions independently. All four participants demonstrated higher levels of engagement and higher levels of correct comprehension question responses during intervention. Teacher procedural fidelity and satisfaction were high for the intervention.</td>
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<td>Mucchetti (2013)</td>
<td>Adapted storybooks (3) that included picture supports and embedded tactile objects, read aloud, picture response boards, teacher task analysis for systematic instruction and least to most prompting system for error correction.</td>
<td>Number of unprompted correct responses to comprehension questions, and momentary time sampling intervals for engagement with shared story. Four elementary students, ages 6 to 8. Autism and moderate to severe ID.</td>
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<tr>
<td>Petrill, Logan, Sawyer, &amp; Justice (2014)</td>
<td>Shared storybook reading in the home.</td>
<td>*Correlation between literacy practices at home via storybook reading and emergent literacy 212 preschool children, ages 3 to 5. Significant language Findings demonstrated moderate correlation between storybook reading frequency and print knowledge</td>
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</table>
Part of a larger pre-post randomized controlled trial.

- Correlation between frequency of storybook reading and level of literacy skills.

* Correlation between frequency of storybook reading and level of literacy skills.

Impairment, some had co-occurring conditions such as autism (24) and Down syndrome (6).

Low frequency levels of storybook reading associated with lower levels of print knowledge, but higher frequency levels were not necessarily associated with higher levels of print knowledge.

Rivera, Mason, Moser, & Ahlgrim-Delzell (2014)

Explanatory mixed methods, with an alternating treatments design.

- Number of unprompted correct English and Spanish vocabulary words.

* Number of unprompted correct oral English vocabulary words per intervention type (English vs. Spanish).

The participant steadily increased in English and Spanish vocabulary acquisition over the course of the intervention. There was a more dramatic immediate effect in Spanish; however, by the end of the intervention, English rates exceeded Spanish.

Rivera, Spooner, Wood, & Hicks (2013)

Alternating treatments design, with initial baseline.

- Number of unprompted correct English and Spanish vocabulary words.

* Semistructured interviews and teacher field notes analyzed for qualitative themes.

* Number of unprompted correct oral English vocabulary words delivered in English.

Altogether, both participants steadily increased their vocabulary acquisition. One participant improved more effectively within the English version of instruction, and one participant improved...
<table>
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<tr>
<th>Study</th>
<th>Intervention Details</th>
<th>Participants</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shurr &amp; Taber-Doughty (2017)</td>
<td>Picture plus discussion intervention, which includes read aloud of age-appropriate texts (e.g., newspaper, employee handbook, informational stories), delivery of instruction (e.g., teacher vs. peer), accompanied by picture supports for each type of text, discussion prompts.</td>
<td>Four high school students, ages 17 to 19.</td>
<td>All participants demonstrated overall steady to marked improvement across all three material types from baseline in story retell. Participants had slight improvement in comprehension accuracy, with some variability in the results. The teacher strongly supported the use of visual supports as an effective intervention method.</td>
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<tr>
<td>Shurr &amp; Taber-Doughty (2012)</td>
<td>Literacy intervention with visual supports (picture symbols strip) and discussion pre- and postreading, text read aloud using grade-level expository texts.</td>
<td>Four middle-school students, ages 12 to 15.</td>
<td>Participants demonstrated a 20% to 58% increase in their mean scores for comprehension. All the participants stated they enjoyed the intervention.</td>
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<tr>
<td>Spooner, Kemp-Inman, Ahlgrim-Delzell, Wood, &amp; Ley Davis (2015)</td>
<td>Adapted storybook paired with pictures, displayed on an iPad, and read aloud using text to speech function, systematic</td>
<td>Five elementary school students, ages 7 to 11.</td>
<td>All participants demonstrated a strong increase in correct responses in the task analysis within 3 intervention sessions. All demonstrated</td>
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<tr>
<td></td>
<td>* Number of unprompted correct responses to steps in a task analysis.</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>* Total number of listening</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Generalized vocabulary words.</td>
<td></td>
<td></td>
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<tr>
<td>Multiple probe across participants.</td>
<td>instruction including least-to-most prompts to re-read text when needed.</td>
<td>comprehension questions answered correctly.</td>
<td>multiple disabilities.</td>
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<tr>
<td>Towson, Gallagher, &amp; Bingham (2016)</td>
<td>Dialogic reading program with pause time was the intervention group.</td>
<td>Receptive and expressive language vocabulary were assessed and compared across groups pre- and postintervention.</td>
<td>42 students ages 3 to 5.</td>
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<tr>
<td>Pretest-posttest group design, one intervention and one control.</td>
<td>Regular reading time was used in the control group.</td>
<td></td>
<td>Significant developmental delays.</td>
</tr>
</tbody>
</table>

**Note.** * = Dissertations. ID = Intellectual disability.

The 17 studies reviewed included 14 single-case design studies and 3 group design studies. There was a combined total of 317 participants, including 257 preschool (ages 3-5) students, 45 elementary students, 8 middle school students, and 7 high school students. A total of three studies included preschool students aged 3 to 5. Petrill et al. (2014) and Towson et al. (2016) used group design studies that assessed vocabulary development and letter recognition using shared stories. The only study that assessed comprehension for the preschool-aged children was Golloher (2016). Golloher used a multiple baseline design to evaluate the engagement, listening comprehension, and active responses of three preschool students with visual impairments and autism. The students were instructed using a universally designed adapted storybook program, which the teacher read aloud, paired with real objects to support their visual impairments and systematic prompting to improve their correct completion of steps in a task.
analysis. One student quickly achieved 100% mastery of the task analysis, while the other two made steady upward gains that continued through the maintenance phase.

Most of the studies found in this review included elementary aged students (10 studies). Coyne et al. (2012), which was the only group design study, evaluated the effectiveness of a comprehensive literacy curriculum for 16 students with significant ID. This curriculum included four UDL-based digital books that were scaffolded to improve the passage comprehension of the participants and included embedded prompts to support reading comprehension. These were combined with two interactive digital game programs to teach phonics and phonemic awareness. The digital books were taught one-on-one with teacher and student while, by the end of the study, the students participated in the additional software programs independently. A total of 11 components of literacy were measured, but the only component to demonstrate a significant effect was passage comprehension. Effect sizes for word attack (0.91), listening comprehension (1.00), and concepts about print (.92) were also very strong. The authors suggested that the multiple modes offered in the digital book, including the embedded reading comprehension strategy practice and the use of text to speech, were an important component of student comprehension success.

Of the remaining nine studies, two focused solely on vocabulary development for students who were English learners (Rivera et al., 2013, 2014) and one evaluated the number of conversational turns taken using a communication device during the intervention (Edmister & Wegner, 2015). A total of six of the studies focused on evaluation of text comprehension as at least one component (Armstrong, 2010; Browder et al., 2011, 2015; Edmister & Wegner, 2015; Hudson, 2013; Spooner et al., 2015). Of these six, all used adapted age-appropriate texts, systematic instruction, and a re-reading or repeated reading strategy as part of the intervention.
One study by Browder et al. (2015) used a multiple probe across participants design to assess the effectiveness of electronic story-mapping on the listening comprehension of three elementary students with autism who participated in alternate assessments. All three had vocal language skills and appropriate fine motor skills to access the technology. Sessions were completed via one-on-one instruction in a self-contained classroom setting. A bank of grade-level stories adapted to a second to third grade Lexile analytics measure (www.lexile.com) were used for the intervention. During each session, the student listened to the story passage and was then prompted to complete a story-map using in iPad 3® and the SMART notebook application. Following story map completion, the students were asked comprehension questions based on the story elements included in the map. During the assessment probes, no error correction procedure was used. However, constant time delay was used to teach the definitions of the story elements and a modified system of least prompts was used to teach story map labelling. This prompting system included (a) a prompt to start the read aloud of the story element definition, (b) a prompt to re-read a small selection of the text that contained the correct answer, (c) a prompt to re-read the sentence that contained the answer, and (d) the researcher read the answer aloud and prompted the participant to enter that in the correct place on the story map. A similar prompting hierarchy was used to teach the comprehension question responses. The authors found that story mapping was effective in improving the passage comprehension of narrative text read aloud.

A dissertation study by Hudson (2013) examined the use of a system of least prompts shared story treatment package given by peers to three elementary students (ages 9-11) with moderate ID and some speech or picture symbol communication skills. The read alouds were adapted from a fifth-grade general education text. The students were also able to make choices from a selection and follow simple verbal directions. The study included three peer tutors from
the fifth-grade general education class who were recommended by their teacher and volunteered for the task. Three dependent variables were measured: (a) number of correct responses to comprehension questions up to two listenings of the relevant text, (b) number of correct responses to comprehension questions after the first reading of the text, and (c) number of correct responses to comprehension questions based on a different text read aloud during class. All 15 of the book’s chapters were adapted following set criteria, including reducing the reading level to a Lexile score between 400 and 600. Baseline and intervention included chapters one through five of the text, while the remaining chapters were used for generalization probes. Each chapter had 18 “wh” comprehension questions (three sets of six). The sets of questions were varied each session so the students would not be asked the same comprehension question throughout the intervention. The peer tutors followed a script for the intervention to maintain procedural fidelity. The books were printed on 8 ½ x 11-inch paper and placed in a binder. Each chapter had response boards with nine answer choices for each question. Each word or phrase in the response board was paired with a picture. On each response board, the appropriate “wh” word rule was paired with a symbol and placed at the top. For example, if the question was a “who” question, the top of the response board would have an icon of a person with a question mark and the text “Who tells about a person” below it. Each board also contained a “Help” picture symbol and text. Students could indicate that they needed help by touching the icon or saying “help.”

The students also had a self-monitoring sheet where they recorded their independent and unprompted correct responses to the questions. Students were given some pretraining on “wh”-word concepts using picture cards. This pretraining occurred before baseline. All the participants improved in their correct listening comprehension responses after the text-only prompts. Their independent unprompted correct responses were mixed: two students increased their number of
correct responses, but one decreased. When analyzing percentage of correct responses to questions based on question type, “Why” questions were missed most frequently. “Where” questions were answered correctly the most. Overall, the teachers, the peer tutors, and the students felt that the intervention was important and effective. The data from the pre- and post-attitude surveys from the peer tutors reflected a growth in peers’ willingness to interact with other students with disabilities.

In addition, Mucchetti (2013) taught three teachers to conduct shared story or reading activities using adapted texts to four students with autism (grades K-3). The students had limited vocabulary (20 words or fewer), IQ below 55, and Individualized Education Program (IEP) goals that aligned with the intervention. The participants attended a nonpublic specialized school for students with autism. A multiple baseline across participants with a modified alternating treatment design was used for this study. Three grade-level books were used during baseline. Books two and three only were used during intervention. These two books were adapted to a lower reading level (grades 1.6-1.9), picture symbols were added that connected with the key content words on each page, and tactile objects were included to highlight important story objects. The students also had response boards that included text, picture symbols, and real objects.

During baseline, teachers read the unmodified stories as they normally would. During intervention, the teachers followed a step-by-step task analysis for the delivery of the shared reading activity. These included steps that promoted early literacy skills like reading the title and having the students point to it, modeling how to open the book, pointing to relevant pictures and words while reading, and so on. A total of six comprehension questions were asked during the reading, one after each relevant page was read. The students did not have access to the book once
the question was asked. Instead, students were prompted to respond either verbally or using their response boards. The response boards included four randomly arranged responses (three from the book and one distractor). If the student responded incorrectly or not at all after 5 seconds, then the teacher modeled the appropriate response and then asked the question again. If the response was still incorrect, the teacher gave physical guidance.

This study included two dependent measures: correct responses to reading comprehension questions and activity engagement (i.e., student attending to the activity). Results were strong for both dependent variables. All four students showed immediacy of effect and significant change in level in their comprehension responses once intervention began. Student engagement was also high during the adapted shared story readings (87%-100%).

In a study that combined technology with shared stories to assess text comprehension, Spooner et al. (2015) displayed an adapted grade-level text on an iPad® and used the text-to-speech function to deliver the story. This study implemented a task analysis for student responses based on one used by Browder, Trela, et al. (2007) and Spooner et al. (2014). The task analysis included nine items such as identify the book title or author’s name, turn the pages, select correct vocabulary or answer comprehension questions from a choice of four, and identify the repeated story line. The participants were five elementary students (ages 7-11) with moderate to significant ID who had limited communication skills but could touch picture symbols on an iPad® screen in response to a question. The dependent variables included the number of independent correct responses to the items on the task analysis and the number of correct listening comprehension question responses.

The text was designed to display on an iPad® with two to four adapted sentences per page and each chapter included one pre-taught vocabulary word. Midway through the chapter reading
and then once more at the end, a listening comprehension question was presented for a total of two questions per session. Both questions were literal recall level questions. The screen would show a set of four response options with a picture to correspond with the text of each answer. There was also a question mark option. If the student touched the question mark, an audio would sound that said “I don’t know, read it again.” The student would touch the page to start the question read aloud and then would have time to make a selection. If the student touched the question mark, they would be directed back to the text, which was now highlighted. They would then have another opportunity to answer the question. If the student pressed the question mark a second time, they were directed to a smaller selection of the text that included the answer to the question.

Following intervention, a generalization training session on the task analysis steps was performed using a model-lead-test format. The session the following day would then begin with a probe that included no prompting or corrective feedback to assess whether the skill was maintained from the previous day and could be generalized to a new chapter. During this training, students were taught to select the question mark response if they did not know the answer to a comprehension question so they could listen to the text again. The students demonstrated a strong response to the task analysis training, with all of them improving from very low baselines (30% or less) to consistently performing at 80% accuracy or higher by the end of intervention and through maintenance. Listening comprehension skills showed a steady increase for all students (mean of 0.6% at baseline to 73.32% by the end of intervention). Social validity results showed that all the stakeholders strongly agreed with the intervention and the use of the iPad® for instruction. Two of the students indicated that they wanted to use the iPad® all the time at school.
There is limited literature on the use of shared stories with secondary students. This review found four studies, two of which were conducted by the same research team, that implemented a shared story intervention with middle or high school students. Shurr and Taber-Doughty (2012) used a picture symbols strip along with a pre- and postreading discussion to improve the comprehension of 15 grade-level expository texts for four middle school students (ages 12 to 15) with moderate ID. The texts were selected from the SRA Specific Skills Series (Boning, 1997) of high interest, short (78-108 words) passages written at a seventh-grade reading level. The texts were not adapted but were accompanied by a five-photo picture strip that represented key content information for each story. Participants had to respond to five literal multiple-choice questions per passage following the wh- question format (e.g., who, what, when, where, why, and how). Students chose their answer to each question by pointing to or verbally stating the letter A, B, or C printed in large font on a sheet of paper in correspondence with the answer choices. During baseline, the text was read aloud and then four comprehension questions were asked with the letter response sheet provided. At baseline, the picture symbol strip was added for each story and the students were asked to describe each photo before the text was read. The researcher would give any clarifying feedback needed for the photo descriptions and then would describe each photo while pointing to it. Then they would read the text passage aloud. The researcher would then discuss or comment on each picture again. Following this, four comprehension questions were asked. The results showed improved correct responses by all students. Due to some variability of baseline, there was some overlap between phases, but significant level increases were noted for all participants.

Another study, which this dissertation somewhat replicates, by Mims, Hudson, and Browder (2012) included four middle school students (ages 12 to 14) with autism and severe ID.
This study used adapted grade-level biographies to provide general curriculum access for student participants who spent the majority of their time in a self-contained classroom setting. A total of five biographies were used in this multiple probe across participants and materials design. The texts were adapted by summarizing the biographies, using specific and controlled vocabulary, and adding associated picture symbols for keywords. The biographies were printed and placed in three-ring binders. The length of each biography was reduced so it could be read in one session. Comprehension questions were embedded on relevant pages of the text. A total of eight “wh” questions and three sequence questions (e.g., what came first?) were used. The participants chose their response from an array of four options. These options were a combination of the word and picture symbol. Each response was on a laminated card that was attached to the page with Velcro™. The order and placement of the responses varied with each session so students would not memorize answer order. Also included in the intervention was a graphic organizer with picture symbols to highlight how to answer “Wh” questions (e.g., When you hear What, Listen for a thing) and another graphic organizer for sequencing that showed the text “first” then an arrow to “next” and another arrow to “last.” These were used as part of the least-to-most prompting system to aid in responding correctly to the comprehension questions.

During baseline, biography order was randomly assigned from participant to participant to control for sequence effects and to reduce opportunities for memorization of the text. At baseline, the adapted text was read aloud, with graphic organizers in front of the students. Each comprehension question was asked aloud along with response options. The interventionist waited 4 seconds for the student to respond and then moved on with the story. If the student answered correctly in the first attempt, they were marked as correct.
During intervention, a least-to-most prompting hierarchy was implemented. The story was read aloud and, at predetermined points, a comprehension question was asked. If the student responded correctly, verbal praise was given and the story continued. If the response was incorrect, the interventionist would state the type of “Wh” question being asked and then the rule associated with it, while pointing to the rule on the graphic organizer. Then the interventionist would read the paragraph containing the answer again and ask the question a second time. If the answer was incorrect again, the interventionist would read the sentence containing the answer and then model the appropriate response. Then the interventionist would re-read the question and response options and waited for the student to indicate an answer. If the response was incorrect again, the interventionist would point to and state the answer and then have the student point to the correct response. The same prompting steps were applied for the sequence questions but the student was directed to the sequencing graphic organizer.

A minimum of five baseline data points was taken before the first participant began intervention. During intervention, only three sessions were held for each biography. This was intended to limit potential memorization of the content. A baseline probe was collected for each biography immediately following the previous intervention session and prior to beginning intervention for that specific biography. The results demonstrate a consistently upward trend for all participants during intervention for each biography. For most phases, an immediate drop from the previous intervention phase was seen, but an increasing trend was seen by the third session for most participants and biographies. This dissertation will add to the research results from this study by expanding it to older students and applying a similar treatment package to an employment text and using an iPad® to provide the read aloud.
Only two shared stories studies were found for high school students with moderate to significant ID. One was a manuscript based on a dissertation study (Shurr & Taber-Doughty, 2017) and one was a dissertation study (Kemp-Inman, 2017). Similar to the study they did on middle school students, Shurr and Taber-Doughty (2017) implemented a shared story intervention that included short expository texts (e.g., newspaper article, passage from an employee handbook, and brief informational stories) that included a set of picture supports and pre- and postreading discussion. The participants were three female high school students (ages 18 to 19) with moderate ID. The dependent variable was an evaluation of a story retell by the student. Results indicated a functional relationship between the intervention and the comprehension skills of the student participants.

Kemp-Inman (2017) completed a dissertation study on the use of a shared story intervention with high school students with significant ID. The multiple probe across participants design assessed the effects of the treatment package on the students’ ability to comprehend and discuss the age-appropriate literature. The package included a modified system of least prompts to correct responses to literal comprehension questions following the read aloud. After the read aloud was completed, the students participated in an inclusive book club where they discussed the text. The adapted grade-level text was presented on an iPad2® using the GoBook© app. Two popular fiction novels were adapted and lowered to a Lexile score between 680 to 930L. Students responded to sequencing and multiple-choice questions on the device as well. The sequencing and questions included associated pictures, and the students responded by touching the correct answers on the iPad® screen. These options were read aloud to them using the text-to-speech tool. During the book club, the group completed a story map with the guidance of the researcher. Then a list of literal and higher-order questions was presented for discussion.
Student responses to these questions were recorded. The participants demonstrated improved literal comprehension of the text overall. They also generalized this skill to the book club sessions as well.

In all studies that assessed text comprehension in some degree (13), slight to significant levels of improvement were found in the use of the shared story intervention. The remaining studies, which were focused on vocabulary acquisition (3) and communication (1), also found that the shared story method of instruction was effective for making progress on their dependent variables. Overall, this review supports the findings of Hudson and Test (2011), that shared story interventions are effective in building the comprehension of individuals with significant cognitive disabilities. The research base needs to be expanded to include older students, such as college-age, with moderate ID.

**Technology and Multimedia Instruction**

The use of technology has vastly changed the learning environment over the past several decades. Advancing technology brings the opportunity to incorporate multimedia instruction with greater ease into the classroom (Bagui, 1998; Fletcher, 2003; Kozma, 1991; Mayer & Moreno, 1998). In doing that, however, it is important to design instruction based on research-based multimedia instruction principles. The recommendations for effective multimedia learning include that text presented (whether written or spoken) should be combined with pictures to benefit understanding, as long as some basic principles are followed (Clark & Mayer, 2003). Those principles include the presence of coherence and contiguity (e.g., words and pictures need to be related and presented at the same time), modality (e.g., individuals learn better when pictures are presented with spoken word), sequencing (e.g., it is better to have the picture come before the word), and reading ability and prior knowledge (e.g., poor readers benefit more from
pictures accompanying text) (Mayer, 2005, 2009; Schnotz, 2005). The use of pictures and written and spoken text has the potential to benefit all readers (Mayer, 2005), and current portable technology provides an excellent opportunity to add pictures and spoken text to any writing with relative ease.

According to Browder et al. (2014), there is a moderate to strong evidence base for the use of technology to instruct individuals with ID in academic and functional skills. Computer-assisted instruction (CAI), has demonstrated moderate evidence to teach skills if systematic instruction is used to teach technology use (e.g., task analysis; Ayres, Mechling, & Sansosti, 2013). Ayres et al. also recommend that teachers stay up-to-date on the technology, take data on technology use, understand traditional effective instruction methods for this population, and analyze whether technology use is more efficient. Successful use of technology tools for individuals with ID is significantly limited without these elements.

One method of providing Mayer’s (2005, 2009) recommendations for effective multimedia learning is to apply the principles of Universal Design for Learning (UDL) to the technology and/or the intervention. Coyne et al. (2012) explored the use of UDL by incorporating technology into instruction to make literacy more accessible for young adults with significant cognitive disabilities. By using a comprehensive curriculum based on the UDL components of multiple means of representation, multiple means of expression, and multiple means of engagement (Rose & Meyer, 2002), the Literacy by Design curriculum provided an engaging and scaffolded literacy intervention for young adults with significant cognitive disabilities (Coyne et al., 2012). The curriculum included four digital storybooks with embedded supports for comprehension, vocabulary, phonics, and fluency, along with supporting e-books, and interactive games and exercises. In the Coyne et al. (2012) study, the composite listening
comprehension score effect size was 1.00, demonstrating a very high effect (Scruggs & Mastropieri, 1998).

The use of CAI to support academic instruction for students with developmental disabilities has evolved from a promising practice (Pennington, 2010) to one with moderate supporting evidence (Knight, McKissick, & Saunders, 2013). The ease of CAI has increased with growing access to relatively inexpensive and convenient portable electronic devices such as iPods® and iPads®. Mechling (2011) reviewed the literature on the use of portable electronic devices for people with moderate intellectual disability and autism. In the review, Mechling found positive results overall, even across a variety of settings (e.g., work, school, and the community) and skill types (e.g., functional skills, time and task management, and transitions), with the key benefit being the portability of the technology.

In their review of the use of touch-screen mobile devices by people with developmental disabilities, Stephenson and Limbrick (2015) determined that interventions were overwhelmingly effective. The studies they reviewed reported mean effect sizes (percentage of nonoverlapping data or PND) ranging from 79.1 to 92.8. Scruggs and Mastropieri (1998) advise that an intervention be called very effective if there was a PND of 90 or more and effective if over 70. Of the 25 small n studies reviewed, 18 studies included high school or young adult (up to 27) aged participants. These studies were mostly regarding communication (10), self-prompting systems (12), and leisure activities (3).

Kagohara et al. (2013) reviewed 15 single-case studies on the use of iPods® and iPads® for instruction for individuals with ID. The studies covered a variety of activities from academic, employment, leisure, communication, and transitioning skills. Although not every participant in the studies demonstrated gains, overall the use of the technology in the studies led to gains for
most participants. Participants reported enjoying the use of the devices and enjoyed the ability to receive remote prompting rather than a person always giving instruction or direction.

The review by Kagohara et al. (2013) included searches of the literature up to June of 2012. To obtain the most current information in handheld technology use for young adults with ID, a systematic review of the literature, modelled from the Kagohara et al. (2013) review, was conducted from 2012 to 2017 (see Appendix A for literature table). The following databases were used in the search: Academic OneFile, ERIC, ProQuest, PsycINFO, SAGE journals online, Science Direct, and Scopus. The search terms included combination of the following free-text terms with truncation and Boolean operators: iPod, iPhone, iPad, portable multimedia device, developmental disability, intellectual disability, autism spectrum disorders (ASD), and autism. Delimiters included English only and peer-reviewed sources. Inclusion criteria were (a) at least one participant had ID, (b) at least one high school or post-high school participant (between the ages of 18 and 22), (c) single-case research designs that included quality indicators recommended by Hudson and Test (2011), and (d) a handheld electronic device (e.g., iPod®, iPad®) had to be used in the intervention to teach a skill. Initial searches led to 71 results, which were further reduced by deleting duplicates to the Kagohara et al. (2013) review and a deeper application of the inclusion criteria. A total of 13 studies remained.

An iPod® or iPod Touch® were used in eight of the studies. These primarily included functional skills training of some kind. Cannella-Malone, Brooks, and Tullis (2013) used video prompts displayed on the iPod Touch® to teach four high school students with moderate to profound ID to wash tables and vacuum. All four participants improved their number of steps completed correctly from baseline (range of 7% to 57%) to intervention (range of 83% to 100%), although only two students showed significant progress in both skills.
A study by Wu, Cannella-Malone, Whaton, and Tullis (2016) also taught table-washing as well as window washing skills to two high school students with moderate to profound ID using video prompts on an iPod Touch®. Both students eventually achieved mastery of the two skills taught. Cannella-Malone, Wheaton, Wu, Tullis, and Park (2012) taught two daily living skills to three high school students with moderate to profound ID using video prompting with and without error correction on an iPod Touch®. All three participants improved from baseline; however, only two met mastery criterion for one of the skills. Error correction led to faster acquisition of skills for two of the three participants.

Another study by Kelley, Test, and Cooke (2013) taught four adults with ID attending a postsecondary education program to independently navigate to and from a variety of locations on a college campus using picture prompts and video on an iPod®. The students increased in correct steps from baseline (3.4% to 4.3%) to intervention (88.25 to 92.1%) with a PND of 100%. The students continued to hang onto the skills they learned with 100% accuracy in maintenance.

Scott, Collins, Knight, and Kleinert (2013) taught one 17-year-old student with moderate ID how to use an ATM machine via video prompting on an iPod® along with an error correction procedure that involved reviewing the video. The participant increased percentage of correct steps in the task, and the percentage of prompts needed to complete the steps steadily decreased over the course of the intervention. This indicates that the iPod® increased overall task independence. Payne, Cannella-Malone, Tullis, and Sabelny (2012) used video prompting and some in vivo training to teach two young adults with autism and ID to complete the steps in two recipes. They also taught the students to access and use the iPod® independently. At intervention, both participants immediately increased their levels of each dependent variable in the study. Wu, Wheaton, and Cannella-Malone (2016) taught four high school students with hearing loss and
mild to moderate ID to access and navigate two types of applications on an iPod Touch®. One was a video prompting app and the other was a picture schedule app. They used a least-to-most prompting hierarchy as well as multiple exemplar training to teach the skills needed. This study demonstrated strong evidence of effect (100% PND) and increase in skills between baseline (very low levels) to intervention (over 90%). In another study, Uphold, Douglas, and Loseke (2016) successfully taught six college students with mild to moderate ID and autism to program and view photos of exercises on an iPod Touch. The participants learned how to program the devices within four to six sessions. These results suggest students can be taught to independently access instructional materials on handheld devices as well as make improvements in the skills being shown on the device.

The remaining four studies used iPads® or a combination of computer, laptop, and iPad® and primarily focused on academic skills, apart from one shopping skills study. Cihak, McMahon, Smith, Wright, and Gibbons (2015) used peer tutors and total-task chaining to teach four college students with ID attending a postsecondary education program to use a desktop computer, laptop, and then an iPad® to access, respond, and write new emails to the peer tutor. The participants were most successful with the laptop (94% steps correct) and then the iPad® (89%). All participants achieved mastery in all three types of technology. Similar results were found by Burckley, Tincani, and Fisher (2015) when they used picture and video prompts on an iPad® to increase the percentage of shopping task analysis steps completed independently for an 18-year-old with autism and ID. The participant eventually achieved 88% correct steps during the maintenance phase. Social validity data suggested that the iPad® format was effective and easy to use.
Two of the studies taught math skills via the iPad®. Weng and Bouck (2014) used video prompting, a number line, and most-to-least prompting to teach three male middle and high school students with autism and mild to moderate ID to understand price comparison. The researcher video recorded 18 task-analysis steps having to do with grocery shopping using a first-person perspective. The 18 different video clips (one for each step in the task analysis) were then edited and audio cues were added. These were all loaded into an iBook® in step-by-step sequence. The students had to touch and swipe on the screen to go to the next page and then hit the appropriate icon to play the clip. The dependent variable included the mean percent correct for the participant selecting the lowest-price grocery item from a choice of three. During intervention, the students had access to a number line and time to watch the video clips of each step prior to embarking on the step. This study ended in mixed results. One participant did not make improvements, even with the addition of a most-to-least prompting hierarchy. The other two participants did demonstrate effectiveness of the intervention, however. One participant increased from a mean of 25% at baseline to 77.5% at intervention. The other participant improved from a baseline of 20% to 40% accuracy with video prompting alone. The researchers then implemented a most-to-least prompting system and this participant reached 96.7% accuracy.

In another study involving math instruction, Creech-Galloway, Collins, Knight, and Bausch (2013) used a treatment package that included video applications of the Pythagorean theorem played on an iPad® along with a simultaneous prompting procedure and calculator to teach four high school students with moderate to severe ID. The participants were three males and one female ranging (ages 15 to 17) in a self-contained classroom for students with moderate to severe ID. All four qualified to take the state’s alternative assessment. The dependent variable measured the independent completion of the steps to a task analysis to solve a math problem
using the Pythagorean theorem. The task analysis included labeling the picture used in the problem, completing a graphic organizer, and using a calculator to solve the problem. A total of six videos of real-life demonstrations of solving similar problems were used. Intervention began with a probe where the video was shown and the student was asked to complete the problem. If the student made errors, the session was ended. The probe session was followed by a training session using a different video where the researcher used total-task chaining to teach the task analysis steps. All the participants improved dramatically from baseline. Three even achieved 100% accuracy within four sessions and they were able to generalize the skill to a novel problem. The authors stated that the students were highly motivated by the videos on the iPad®.

The final study by Hart and Whalon (2012) used video modeling on an iPad® to teach correct responses to science questions to a high school student with autism and moderate ID. This ABAB reversal design studied the effect of video self-modeling, delivered on an iPad®, on the participant’s unprompted correct responses to questions during science instruction. They filmed the student answering questions correctly, without prompting, as well as audio that reinforced the appropriate behaviors. This was then used as the training video. Their results were variable but he demonstrated higher levels of correct responses in the intervention phase (24-42%) as compared to baseline (4-6%). The study took place in a high school resource classroom along with the regular pace of the class group. The teacher stated that the intervention was generally easy to use and did not draw too much attention to the student.

Much like the Kagohara et al. (2013) review, this review demonstrated that handheld technology does have an overall positive effect on instruction results for young adults with ID in both functional and academic skills. Although not every participant in every study demonstrated a significant improvement, most achieved very well on their individual measures. These results
support the use of handheld technology such as iPods® and iPads® to teach literacy skills, such as comprehension, and provide necessary supports, such as pictures and read aloud of the text, for young adults with ID. This corresponds with the findings of general multimedia learning research, which supports the benefits of combining pictures along with written and spoken text (Mayer, 2005).

**Postsecondary Interventions for College Students With ID**

After reviewing the literature on the literacy and technology supports for the instruction of students with ID at a variety of ages and stages, the following section will look specifically into how young adults with ID in college postsecondary education programs are currently receiving instruction. The Higher Education Opportunity Act (2008), which encourages programs for students with ID to attend college, was not passed until 2008; therefore, most of these college-based programs are relatively new and a large research base does not yet exist. A systematic review of the existing literature was performed to determine what instructional intervention in postsecondary education programs exists between the years of 2006 to 2017. The search included peer-reviewed sources in English. The following databases were searched: Academic Search Premier, Education Full Text, ERIC, Sage Online Collection, including a manual search through reference sections. Search terms included intellectual disabilities, intellectual disability, mental retardation, postsecondary education, reading, literacy. Initial results included over 1,400 studies. Inclusion criteria were (a) participants were part of a university-based postsecondary education program (b) and results were published in peer-reviewed journals. Titles, abstracts, and full articles were reviewed for inclusion criteria and duplicates removed, resulting in 15 studies. The following is a synthesis of those studies. For detailed information on each study, see Appendix A.
The resulting studies included a variety of instructional categories from functional skills, to employment skills, to academic skills. Functional skills were taught in five of the studies reviewed, most using technology within the intervention. For example, two studies examined how to improve pedestrian navigation skills for participants using technology. Kelley et al. (2013) used video prompts on an iPod® to teach four young adults with ID to travel specified routes independently. All participants were successful in independently travelling to the given locations with 100% accuracy by the maintenance phase. McMahon et al. (2015) also assessed pedestrian navigation skills using location-based augmented reality and compared it to the use of Google Maps™ mapping service and paper maps. The participants included three college students with ID and one with autism. The students travelled more successfully overall using the augmented reality tool.

Two of the studies looked at employment skills, including time management. Gilson and Carter (2016) provided a job coaching package that used technology to fade physical proximity coaching by transitioning to an audio coaching system to three college students with autism and ID. Task engagement was maintained even after fading to the audio system. This way the job coach did not have to be right next to the participants to keep them on track in their work environments. Green, Hughes, and Ryan (2011) used a vibrating watch to alert a college student with ID that it was time to finish up work and head to her class across campus. Over the course of the study, the participant significantly reduced her time late to class (approximately 15 minutes). Kelley, Rivera, and Kellems (2016) used systematic instruction (model-lead-test) to teach three college students with mild to moderate ID to use a Google glass device. Results demonstrated a functional relation between systematic instruction and the student performance of the steps for all participants.
Functional math skills were addressed by Hua and colleagues in two separate studies. Hua, Morgan, Kaldenberg, and Goo (2012) used a 3-step cognitive strategy called TIP to teach young adults to calculate a tip and total bill. A total of 10 college students with learning disabilities, autism, and ID were included. The treatment group was more successful than the control group and they were able to generalize the skill to tasks involving percentages. Hua, Woods-Groves, Kaldenberg, Lucas, and Therrien (2015) used the same TIP strategy in a group design study including 14 college students with ID. The treatment group outperformed the control group in calculating tip and bill amounts, with five participants generalizing the strategy successfully to a real-life situation.

The remaining eight studies in the review focused on academic and self-advocacy skills. Mazzotti, Kelley, and Coco (2015) taught students to develop their own summary of performances and use that process to teach self-advocacy skills. They measured levels of participation during person-centered planning meetings, which included advocating for accommodations and needed supports. The three college students with ID who participated increased their participation and were able to generalize the skill to employment settings. Another important skill needed in navigating a college-based program includes navigating, reading, and writing emails. Wang, Eberhard, Voron, and Bernas (2016) used email modeling and scaffolding with teacher candidates used as models to teach social writing quality to 10 college students with autism and ID. The results demonstrated various degrees of improvement in writing mechanics and cohesion as well as motivation. Overall, figurative language was not affected by the intervention.

A total of three of the studies addressed vocabulary acquisition and one measured writing improvement. McMahon et al. (2015) used augmented reality applications to teach science
vocabulary to four young adults with autism and ID. The researchers applied the principles of UDL to present the information to the participants through short videos including the vocabulary term, a definition of the text that is read aloud, a labelling image, a 3D simulation where the definition was read aloud again, and then the labelling image with audio of the definition one more time. These videos were made for 30 science terms. The dependent variable was the number of correct responses to a vocabulary assessment. The results were very effective with a PND for participants of 85%, 89%, 79-94%, and 92.9-100%.

In another study, Hua, Woods-Groves, Kaldenberg, and Scheidecker (2013) used constant time delay to teach vocabulary that was embedded in expository texts in an alternating treatment design to four college students with ID. The researchers developed 12 expository passages, written at a Flesch-Kincaid reading level range of 5.0 to 8.1, that included three unknown vocabulary words each. When the vocabulary word was mentioned, a definition was placed next to the sentence that contained the vocabulary word. The participants were then assessed via 10 comprehension questions per passage (i.e., three vocabulary questions and seven factual recall questions). Comprehension results were inconclusive, but vocabulary acquisition was greater during treatments than during control. The authors suggested that vocabulary knowledge alone is not enough to teach comprehension; instead, further instruction on other comprehension strategies is needed for this population.

Five of the reviewed studies explored text comprehension instruction in some aspect. Chezan, Drasgow, and Marshall (2012) used general-case programming to teach a 21-year-old college student with ID to access and locate information on course syllabi, information in personal accounts (e.g., banking and email), and important coursework information (e.g., email from professor, item on the online learning system) using technology. The investigator used
constant time delay to provide error correction through the intervention. The participant achieved 100% accuracy on all measures. He had moderate results with generalization probes. This study was not explicitly about text comprehension, but did include performance related comprehension and reading and understanding of keywords in course syllabi.

Hua, Thierren, Hendrickson, Woods-Groves, Ries, and Shaw (2012) used the Reread-Adapt and Answer-Comprehend (RAAC) intervention to improve the reading fluency and comprehension skills of three college students with mild ID and severe learning disabilities. In this multiple-baseline across subjects design, the authors developed 27 short reading passages at various grade levels (i.e., grades 1, 2, and 6). The dependent variable was the correct responses to four factual and four inferential comprehension questions per passage. Baseline included a timed fluency reading of the passage followed by the reading comprehension questions. The participants did not have access to the passage when asked the comprehension questions.

During intervention, students were asked to read a series of questions about the overall structure of the passage and prompted to pay attention to those questions during the reading of the passage. The participants could hold onto a cue card with the questions during the reading. They were then given a passage to read. They read the passage aloud three times, with decoding errors corrected following each reading. After the third reading, the student was asked to answer the questions on the cue card. If their answers were incorrect or they did not know, they were prompted to re-read the passage while looking for the answers. If they were still incorrect, the tutor would then have them re-read the specific sentence or sentences that contained the desired information. If their response was incorrect at this point, the tutor would state the correct answer and explain why. Following this, the student would be asked the eight comprehension questions.
The dependent variables included the number of correct words per minute and the number of reading comprehension questions answered correctly. All three participants demonstrated an immediate decrease in decoding errors and a moderate increase in correct comprehension question responses at intervention. Over time, one participant demonstrated a decrease in fluency, which the authors suggested was due to lack of motivation to continue with the intervention.

In a replication of the Hua, Theierren, et al. (2012) study, Hua, Hendrickson et al. (2012) used the Reread-Adapt and Answer-Comprehend (RAAC) intervention to improve the comprehension skills of three college students with autism and moderate ID. Overall the number of correct words read per minute increased and number of errors per passage were decreased in intervention. The number of comprehension questions answered correctly increased slightly. This method was more effective as a fluency builder rather than a comprehension builder.

In two studies by Evmenova and colleagues, alternative narration, highlighted text, and text captions were used in combination with interactive videos to increase comprehension in college students with ID. Evmenova et al. (2011) examined the results of five students (ages 19 to 25), four with ID and one with a significant learning disability and processing disorder, receiving a treatment package of adapted nonfiction videos with alternative narration, highlighted text, picture/word-based captions, and interactive video. The dependent variable for this multiple baseline and alternating treatment single-subject design included number of comprehension questions answered correctly. The multiple baseline was used to assess the effectiveness of an adapted video clip and correct responses to comprehension questions. The alternating treatment compared two different video format types (e.g., motion versus static images). During baseline, participants viewed nonadapted video clips. During intervention, the
narration was simplified to meet the listening comprehension level of the participants. Captions were then added to the top of the video screen. Two phases of captions were also compared: (a) phase II used highlighting of the words as they were read aloud, and (b) phase IV used pictures and words in the captioning. At the end of these phases, the participants were offered the opportunity to go back into the video and search for the answers to any incorrect responses to the comprehension questions. The greatest improvement was seen when the interactive search option was used. The results showed no real difference between the use of static images versus video or picture-based versus highlighted captions.

Evmenova and Behrmann (2014) used a similar treatment package (e.g., alternative narration, adapted video, interactive video, and two types of captioning with highlighted text or picture/word based text) in a subsequent multiple baseline across participants study. This study included six participants (ages 19 to 22) with mild to moderate ID and a wide range of reading levels (Kindergarten through eighth grade). The dependent variable was again the number of correct responses to comprehension questions based on the information in the videos. The videos were adapted from those that aligned with a current events course at the university. Again, the researchers compared the use of picture/word captioning versus highlighting text captioning. All participants improved significantly with the adapted and interactive video interventions. Like their previous study, the researchers did not find any difference in the types of captions. The authors suggest that the alternative narration, captions, and interactive search features were effective in helping students hone in on the important points of the video, and therefore helping them build their comprehension of the information.

The results of the 15 studies in this systematic review demonstrated improvement with the intervention provided. These interventions ranged from functional skills (e.g., pedestrian
navigation, Kelley et al., 2013) to academic skills (e.g., vocabulary and fluency, Hua, Hendrickson, et al., 2012; McMahon et al., 2015; and math, Hua, Morgan, Kaldenburg, & Goo, 2012; Hua, Woods-Groves, Kaldenberg, & Scheidecker, 2013) to self-advocacy skills (Mazzotti et al., 2015). Interventions that focused on literacy-based skills included improving writing skills (Wang et al., 2016), vocabulary in a content area (McMahon et al., 2015), vocabulary in expository texts (Hua et al., 2013), reading fluency and comprehension (Hua, Hendrickson, et al., 2012; Hua, Thierren, et al. 2012), comprehension (Evmenova & Behrmann, 2014; Evmenova et al., 2011), and locating important elements in a text (course syllabus; Chezan et al., 2012). A total of 10 interventions focused on the use of technology, from emails (Chezan et al., 2012; Wang et al., 2016) to Google glassware (Kelley et al., 2016). Not one of the studies used shared stories to aid in comprehension of text. Overall, literacy and technology are being addressed in these postsecondary programs, but to a limited extent.

**Summary of the Research Foundation for the Current Study**

Although literacy instruction for individuals with ID has a short history, and most college-age students with ID have had limited exposure to evidence-based literacy instruction, the research continues to support the potential of this population to improve in literacy skills and overall comprehension and engagement with text (Browder et al., 2014; Evmenova & Behrmann, 2014; Evmenova et al., 2011; Hua, Morgan, et al., 2012). Using systematic instruction, students with ID from preschool to adulthood have made academic and functional skill gains (Browder & Spooner, 2011). Systematic instruction was used to provide supports through prompting systems, reinforcement procedures, and error correction to teach skills such as text comprehension to students with ID (Browder et al., 2014; Mims, Lee, Browder, Zakas, & Flynn, 2012).
Shared stories or read alouds have also developed an ever-growing evidence base (Hudson & Test, 2011). During shared stories, grade-level texts are often adapted and supplemented with visual supports to further develop comprehension of the text (Browder et al., 2014). Within those shared stories, opportunities for student engagement with the text are frequently provided (e.g., comprehension questions embedded within the text and repeated story lines). Read alouds have been shown to be effective for preschool, elementary, middle, and some high school students, but not much research has been done in using this intervention with postsecondary students with ID.

Incorporating the use of technology with read alouds and systematic instruction expands the ability to provide access to text, even at the postsecondary level (Kagohara et al., 2013; Rivera et al., 2014; Spooner et al., 2015). To support students with ID in their transition to employment, it is necessary to improve access to essential workplace texts. Using technology and proven interventions for literacy may be a means of providing this additional support for employment success.

To reach this goal of successful employment, college-based postsecondary education programs are becoming more important for students with ID to access (Hart, Grigal, & Weir, 2010). Several effective methods of instruction and interventions have taken place in these programs, but the research is still minimal. What little research that has been done in literacy instruction at the postsecondary level includes teaching re-reading strategies (Hua et al., 2012) or alternative narration and highlighting (Evmenova & Behrmann, 2014; Evmenova et al., 2011) and the use of multiple exemplars to teach access to college-related expository text such as a class syllabus (Chezan et al., 2012). Although these were effective, no research has combined the
use of shared stories with adapted texts, systematic instruction, and technology to teach college-age students with ID how to comprehend important workplace texts.

**Potential Contribution of the Current Study**

Workforce projections for 2018 anticipate that 63% of jobs will require postsecondary education (Carnevale, Smith, & Strohl, 2011). This statistic brings into sharp focus the need for postsecondary programs for individuals with ID to provide the intensive training and preparation required for these students to be independent and successful in employment. Legislative mandates support the importance of programs that are focused on this critical period of transition (HEOA, 2008; Workforce Innovation and Opportunity Act, 2014). Although employment and quality of life outcomes remain poor for individuals with ID, the more education they can obtain, the better their chances for employment become (Migliore et al., 2009; Smith, Grigal, & Sulewski, 2012). In a survey comparing the life outcomes of students with ID who had attended at least some college and those of others with disabilities who had not, Butler, Sheppard-Jones, Whaley, Harrison, and Osness (2016) discovered that those who had gone to college had far healthier exercise habits, took fewer medications, had more jobs (37% compared to 13%), and had higher numbers of friends (83% compared to 54.2%).

While the purpose of these programs is important, it is essential to investigate the most effective practices to best prepare college students with ID for a postsecondary life of independence and successful employment. Education law supports aligning instruction to age-appropriate content (Every Student Succeeds Act, 2015; HEOA, 2008, Individuals with Disabilities Education Act, 2004), as well as the significance of literacy instruction to make informed links with important text (Browder et al., 2009, 2014; Keefe & Copeland, 2011). For individuals with ID, who generally have very low reading levels and therefore struggle with
comprehension, providing tools and supports through technology and systematic instruction for access to important texts such as employee manuals is an essential component in the transition training process.

The present study addressed the gaps in literacy instruction for young adults with ID by evaluating the use of an adapted employee handbook designed using the principles of UDL and multimedia learning displayed on a portable electronic device with visual and audio supports, to create greater accessibility to this important text. Systematic instruction, an evidence-based practice for teaching individuals with ID (Browder et al., 2011), was used in combination with adapted texts, shared stories, and technology (Rivera et al., 2014; Spooner et al., 2015) to build comprehension of an employee handbook. The purpose of this study was to evaluate the effectiveness of a multimedia shared story using speech-to-text technology on the text comprehension of an adapted employee handbook presented on an iPad Air®. This study focused on using systematic prompting to teach research-based literacy strategies that supported text comprehension for individuals with ID such as a graphic organizer (Knight et al., 2013), re-reading strategies (Hua et al., 2012), frequent comprehension checks (Hudson & Test, 2011), systematic instruction that included a least-to-most prompting system (Browder et al., 2014), and a read aloud or shared story feature (Mims et al., 2012; Hudson & Test, 2011), all displayed on a portable electronic device (Rivera et al., 2013, 2014; Spooner et al., 2015). This intervention also included two basic types of assistive technology support for reading for people with disabilities: tools that provide repetitive instructional opportunities to improve skills and tools that help bypass barriers to reading (Day & Edwards, 1996; Edyburn, 2003).
CHAPTER THREE: METHOD

Postsecondary outcomes for young adults with ID continue to be meager, especially in the areas of employment and overall independence (Thoma et al., 2011; Wagner, et al., 2005). Much of the limitations they endure stem from limited literacy skills, which is essential for both employment and independence (Conceição, 2016; Houston & Torgerson, 2004). Little research has been done on improving literacy skills and access to everyday texts for young adults with ID. Technology advancement, including accessibility tools, combined with evidenced-based practices for literacy instruction for younger students with ID, such as shared stories (Hudson & Test, 2011), offer promising potential methods for improving access to and providing instruction in more advanced texts such as an employee handbook through the use of principles of UDL (Rose & Meyer, 2005) and components of multimedia learning (Meyer, 2005).

This dissertation study was designed to add to the current research base for improving the literacy skills of college students with ID by addressing the following questions: (a) Does the application of a multimedia literacy treatment package improve the text comprehension of an adapted employee handbook for college students with ID? (b) Does the application of a multimedia literacy treatment package, using an adapted employee handbook, improve the completion of employment tasks discussed in the text? (c) Was the multimedia literacy treatment package and adapted employee handbook considered an effective method for increasing understanding of important employee concepts by the student participants, the program director, and the employer?

Overview

A single-subject, multiple-probe across participants (Cooper et al., 2007; Gast, Lloyd, & Ledford, 2014) design was used to study the effects of a literacy treatment package on the text
comprehension of an adapted employee handbook for college students with ID. An extended measure of performance of a skill related to the text was also evaluated to determine the effect of text comprehension on the individual participant’s ability to demonstrate workplace skills discussed in the text.

**Participants**

According to Gast and Ledford (2014) a quality single-case design includes a minimum of three participants, but four participants are recommended to allow room for potential attrition. This study included four participants ranging in age from 18 to 21. All had a self-disclosed diagnosis of mild to moderate intellectual disability. All participants were selected from a convenience sample of interested students participating in a university certificate program designed for students with intellectual and/or developmental disabilities. The program director identified students who had expressed interest in working at the university preschool as part of their person-centered planning. These students were then approached by the researcher regarding participation in the study. The final participants were those who signed consent to participate and met the inclusion criteria.

Participants in this study were working toward independence and employment in their postsecondary education program. Part of that program included building academic skills (such as literacy), employment skills, and independence skills. Participants fit the following inclusion criteria for this study: (a) college student participating in the postsecondary education certification program on the university campus, (b) had a diagnosis of ID per parent and/or student disclosure, (c) scored at or below third grade levels of reading comprehension on the *Informal Reading Inventory* (Burns & Roe, 2002), (d) demonstrated physical ability to access the iPad® application, (e) were available to participate at least 2 days per week, (f) were interested in
working for or were planning to work for the university preschool, which was the employee
manual used for this study, and (g) signed consent to participate. All participants were over 18
years of age and were under their own legal guardianship. All study members were informed of
the parameters and expectations of the intervention and gave signed consent to participate in the
study. Each participant’s reading level was assessed prior to inclusion using the Informal
Reading Inventory (Burns & Roe, 2002). All four participants scored at the Preprimer reading
level. All participants were given pseudonyms for discussion in this text. See Table 2 for
participant demographic information.

Table 2

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age</th>
<th>Gender</th>
<th>Ethnicity</th>
<th>Diagnosis</th>
<th>Reading Comprehension Levela</th>
<th>Listening Comprehension Levelb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beth</td>
<td>18</td>
<td>Female</td>
<td>AA</td>
<td>Moderate ID</td>
<td>Preprimer</td>
<td>Preprimer</td>
</tr>
<tr>
<td>Olivia</td>
<td>21</td>
<td>Female</td>
<td>AA</td>
<td>DS</td>
<td>Preprimer</td>
<td>Preprimer</td>
</tr>
<tr>
<td>Nancy</td>
<td>27</td>
<td>Female</td>
<td>W</td>
<td>DS</td>
<td>Preprimer</td>
<td>Preprimer</td>
</tr>
<tr>
<td>Kate</td>
<td>25</td>
<td>Female</td>
<td>W</td>
<td>Moderate ID</td>
<td>Preprimer</td>
<td>Preprimer</td>
</tr>
</tbody>
</table>

Note. AA = African American; W = White (non-Hispanic) ID = Intellectual disability; DS =
Down Syndrome.

aNbInformal Reading Inventory (Burns & Roe, 2002).

Nancy

Nancy was a 27-year-old student in her second year in the postsecondary education
certification program. She was a white, female student with Down Syndrome. When asked about
her interests and postsecondary goals, she stated that she enjoyed bowling, going to the movies,
and participating in her college classes like weight lifting. She also stated that her postcollege
goals included working with children and being organized. When given the *Informal Reading Inventory*, Nancy scored in the independent reading level range for preprimer comprehension passages and instructional level between preprimer and primer reading and listening comprehension. Nancy had a significant visual impairment. She needed text to be at least 30-point font size to see clearly. She was verbal, but she was occasionally difficult to understand because of some speech impairment.

**Kate**

Kate was a 25-year-old, white, female student in her first year in the university postsecondary education certification program. She stated that her disability was “trouble focusing,” although the program director stated that Kate has a moderate ID. Kate was a hard worker and was determined to get to her classes and work in a timely manner. She had an uneven gait when walking, which slowed her down significantly. Sometimes this led to her being very physically tired by the time she reached the preschool or intervention. However, she compensated for her slow pace by ensuring that she started toward her next destination with plenty of time to spare. She also had fine motor skill difficulties. She could access the iPad® but struggled with the rapid double-tap often required to make selections on the touch screen. When asked about her interests and postsecondary goals, she stated that she enjoyed doing her work, listening to her parents, bowling, and going to the buffet. She also said that she would like to work with children someday. Kate scored in the preprimer level for independent reading and listening comprehension when given the *Informal Reading Inventory*. She was verbal and easily understood when she spoke. When working, Kate sometimes hurried through tasks to get them done without concern for completing the task correctly.
Beth

Beth was an 18-year-old, African American, female student in her first year in the postsecondary education program. She was not able to say what her disability was. The program director reported that she had a mild to moderate ID. Beth shared that her strength was that she was organized. When asked about her interests and postsecondary goals, she stated that she enjoyed watching TV, working with her dad in construction, and working with children. She has previously indicated that she was interested in gaining work experience at the university preschool. When given the Informal Reading Inventory, Beth scored at the independent and instructional reading levels for preprimer reading and listening comprehension passages. Beth was verbal and had no physical challenges that affected her ability to navigate the college campus or her classes.

Olivia

Olivia was a 21-year-old, African American female student in her first year of the university postsecondary certification program. Olivia was verbal, although occasionally difficult to understand. When interviewed, she shared that she had Down Syndrome. She walked very slowly and was frequently late to classes if she was not prompted to leave with plenty of time to travel. On occasion, this meant she would run late to intervention sessions at the preschool. She was only on campus 2 days per week (Mondays and Wednesdays), which meant that she only received 2 days of instruction per week. When asked about her strengths, interests, and postsecondary goals, she stated that her strengths were “everything,” which included dancing, singing, and modelling. She also reported that she loved going out to eat and wanted to get a job after she completed the postsecondary program. When asked where she would like to work, she stated that she would like to work at Taco Bell® and that she loves kids. When given the
Informal Reading Inventory, Olivia reached 100% accuracy on word recognition up to level 5. When given reading passages, however, her independent reading level was preprimer. She reached the primer level for listening comprehension as well.

**Setting**

The reading instruction sessions primarily took place in the conference room or breakroom of the preschool building located on a state, accredited university campus in the southwestern United States. The performance task was held within the natural environment of the preschool building. Occasionally, there were some staff present, but overall, quieter areas were sought out to engage in the performance task unobtrusively. Instruction took place in a one-to-one ratio. The participant was seated at the conference table or lounge chair next to the researcher and given the iPad®. To build higher levels of independence and increased access to text, the participants were taught to use the text-to-speech (VoiceOver) feature built into the iPad Air® (Kagohara et al., 2013). The interventionist sat next to the student during the intervention to verify answers given to comprehension questions. During procedural fidelity and inter-rater checks, an observer sat across the table from the participant. The interventionist was near enough to see whether each skill was completed correctly during skill assessment.

**Researchers**

The researchers were two full-time doctoral students in special education. The primary researcher had 7 years of experience as a special education teacher working with students with moderate to severe ID and/or autism and 2 years of experience teaching in higher education. She had a bachelor’s degree in English and a Master’s in Special Education and was the primary researcher and trainer for this study. Included in her responsibilities were (a) obtaining university IRB approval for the study, (b) obtaining and adapting the employee handbook, (c) obtaining and
training secondary observers for interrater agreement and procedural fidelity, (d) obtaining study participants, (e) coordinating data collection and intervention, as well as (f) continuing and supporting ongoing communication with her dissertation committee. The second researcher was a doctoral student with 4 years of experience as a special education teacher for students with significant cognitive disabilities. He was also the program director of the postsecondary education program at the university. Prior to beginning any sessions, the second interventionist was trained in the procedures and implementation of the intervention. He received a 45-minute training session prior to baseline and an additional 30-minute training prior to intervention. The second researcher then had to demonstrate three consecutive sessions of 100% accuracy in delivering the baseline and intervention procedures before the study began.

An additional observer for this study included one recent doctoral graduate. This observer was used to collect interrater reliability and procedural fidelity data by directly observing baseline, intervention, maintenance, and generalization sessions. The observer was trained by the researcher in the procedures for each phase as well as how to complete the data collection materials. Review of data and discussion of any disagreements or questions took place following the initial baseline and intervention sessions to clarify any concerns.

Materials

This intervention included several types of materials. The preschool employee handbook was adapted using an *iBooks Author*® program (Apple Inc., 2013). *iBooks Author*® is a software platform that allows the user to develop an electronic book that can include text, images, videos, and interactive quiz tools. Once the book was built, it was exported as an iBook® and uploaded onto an iPad Air®. All images used in the text were taken from Google Images™ search service. During intervention, participants also had two hard-copy graphic organizers to use as a support
tool. One organizer was for using the VoiceOver accessibility tool on the iPad Air® and the other organizer was a guide for answering “wh” questions. Supplies for the performance tasks were also available for student use. These supplies included a phone and a sink equipped with soap and paper towel dispensers on the university preschool campus.

Adapted Text

The primary researcher worked closely with the preschool director to modify key sections of the employee handbook. The director chose the sections that she felt were essential to the types of jobs students have at the preschool. The text passages were then adapted from the original university preschool employee handbook to a 200 to 500 Lexile range. This range fell within the independent reading level of the participants per The Lexile Framework for Reading website (www.lexile.com). According to the Typical Reader Measures by Grade table, passages with 200 to 400 Lexile level are appropriate for beginning readers to a second-grade reading level. Browder, Trela, et al. (2007) also recommend using a Lexile of 400 to 600 for students with moderate to severe ID. A free Lexile Analyzer tool located on the Lexile.com website was used to evaluate the final ranges for each page of text. The three sections of the handbook were developed with the preschool director to provide essential information for a student intern. The adaptations were then reviewed by two experts in special education literacy for individuals with moderate to significant cognitive disabilities, one expert in learning technology, and again by the preschool director to ensure that the content accurately reflected the essential elements of the original text and that all three sections were of comparable difficulty and level of information.

The text was built in iBooks Author® and was designed to incorporate the principles of UDL (Rose & Meyer, 2002) and align with Mayer’s (2005, 2009) recommendations for effective multimedia learning (e.g., reducing extraneous processing, managing essential processing, and
fostering generative processing). The multiple means of representation component of UDL was incorporated by adding relevant pictures to each page, using the VoiceOver™ accessibility tool to read the text aloud, reducing the reading difficulty of the text, enlarging the font size of the text, and embedding comprehension questions throughout.

A total of five literal comprehension questions were included in each section of the handbook. All five questions were associated with a “wh” word (e.g., who, what, where, when, why). The questions, which were also reviewed by the panel of experts, were designed to align with Browder et al.’s (2011) recommendations for comprehension question vocabulary for individuals with moderate and severe disabilities. The vocabulary used were based on the levels of Bloom’s Revised Taxonomy (Anderson & Krathwohl, 2001). The questions for each section included three written at the Knowledge level, two written at the Comprehension level, and one written at the Application level (see Table 3). The performance task evaluated the Application level of the taxonomy. An iPad Air® was used to deliver the text. The built-in text-to-speech tool called VoiceOver was used to read the text aloud during intervention. A total of nine versions of the handbook sections were created (three for each section). Within each section, page orders and answer selection orders were shuffled to reduce memorization of the order.

Table 3

<table>
<thead>
<tr>
<th>Comprehension Questions and Performance Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Employee Handbook Questions</strong></td>
</tr>
<tr>
<td><strong>Section 1</strong></td>
</tr>
<tr>
<td><strong>Question 1</strong>: Identify what is a UNLV Preschool Goal.</td>
</tr>
<tr>
<td>Answer: We want children’s learning to grow. We want children’s friendships to grow.</td>
</tr>
<tr>
<td>Distractor 1: We want children to be at school on time.</td>
</tr>
<tr>
<td>Distractor 2: We want children to be friendly to animals.</td>
</tr>
<tr>
<td>Distractor 3: We want UNLV students to stay away from the Preschool.</td>
</tr>
</tbody>
</table>
Question 2: Locate when the Preschool is open on Mondays.
   Answer: 8:00 a.m.
   Distractor 1: 6:00 p.m.
   Distractor 2: 8:30 a.m.
   Distractor 3: 9:00 a.m.

Question 3: Describe what happens if you need to keep missing work.
   Answer: You may need to change your schedule.
   Distractor 1: Your supervisor will tell your parents.
   Distractor 2: You should go to the doctor.
   Distractor 3: You should tell your friends.

Question 4: Identify what answer is a description of a requirement listed on the General Staff Requirements page?
   Answer: No arrests or record of child abuse or neglect, hurting someone else, or alcohol or drug use.
   Distractor 1: Tell your supervisor when you cannot be at work.
   Distractor 2: You get a break for every 4 hours you work.
   Distractor 3: You do not need to be in good physical and mental health.

Question 5: Identify who you should ask for help if you don’t know the answer to a question.
   Answer: Your supervisor
   Distractor 1: The Grasshoppers class teacher
   Distractor 2: The classroom teacher and your supervisor
   Distractor 3: Don’t ask for help.

Performance Task: Show me how to use the intercom to contact the Admin Office.
   Step 1: Push the intercom button on the phone.
   Step 2: Dial 06 to call the Admin Office.

Section 2

Question 1: Select what you should do after you sign in on ProCare.
   Answer: Report to assigned classroom.
   Distractor 1: Take down chairs.
   Distractor 2: Make the sanitizing and disinfectant bottles.
   Distractor 3: Ask children to put backpacks and coats in cubbies.

Question 2: Explain why you cover the ice pack with a sock or cloth before you use it.
Answer: So the ice won’t hurt/burn the children’s skin.  
Distractor 1: So you can write an Ouch report.  
Distractor 2: So you keep your hands warm.  
Distractor 3: So the ice pack stays clean. 

Question 3: Explain what you need to do at the end of every shift.  
Answer: Sign out.  
Distractor 1: Put chairs on top of tables.  
Distractor 2: Check and clean up centers.  
Distractor 3: Wipe tables and chairs. 

Question 4: Select what you should always remember about fire drills.  
Answer: Walk calmly and safely.  
Distractor 1: Tell your supervisor.  
Distractor 2: Follow the classroom teacher.  
Distractor 3: Fire alarms are by the door. 

Question 5: Describe when you need to wear gloves.  
Answer: When touching blood or body fluids.  
Distractor 1: When putting toys and equipment away.  
Distractor 2: When picking up trash from classroom floor.  
Distractor 3: When setting up the playground. 

Performance Task: Show me the handwashing procedure.  
Step 1: Use water.  
Step 2: Use soap.  
Step 3: Scrub for 20 seconds while singing the ABC song.  
Step 4: Rinse hands. 

Section 3

Question 1: One staff member is cleaning tables during lunch. Describe what the other staff member does during this time.  
Answer: One staff member takes children to next activity.  
Distractor 1: One staff member puts lunches away.  
Distractor 2: One staff member reads to the children.  
Distractor 3: One staff member helps children wash hands. 

Question 2: What should you do to help children rest?  
Answer: Gently rub or pat their backs.  
Distractor 1: Give out blankets and stuffed toys.  
Distractor 2: Play loud music.  
Distractor 3: Keep cots 3 feet apart.
Question 3: What are the 5 steps to setting up the sandbox?

Question 4: Identify the first safety rule.
Answer: We keep our body safe.
Distractor 1: Tell the classroom teacher.
Distractor 2: Pick up the trash.
Distractor 3: Follow the emergency procedures.

Question 5: What is one of the 4 questions children should be able to answer while doing an activity?
Answer: What am I supposed to be doing?
Distractor 1: Where is my friend?
Distractor 2: Why am I doing this?
Distractor 3: When is the activity over?

Performance Task: Tell me the 3 Safety Rules.
Rule 1: We keep our body safe.
Rule 2: We keep our friends safe.
Rule 3: We keep our toys and materials safe.

Graphic Organizers
An 8.5" x 11", full-color graphic organizer with pictures and basic text that outlines what to look for when answering “wh” questions, similar to Mims et al. (2012), was placed next to the student during intervention (see Figure 1). A second 8.5" x 11", black and white graphic organizer with pictures and basic text was used to support iPad® navigation when VoiceOver was turned on (see Figure 2). The iPad® and employee manual text were available for access by the student participant during the skill assessment as well as during maintenance and generalization.
Figure 1. “Wh” graphic organizer.
Figure 2. How to use VoiceOver (read aloud) graphic organizer.
Data Collection

Data collection forms for recording number of correct responses to the comprehension questions were designed in a Microsoft Excel® spreadsheet, and hard copies were used to record responses. All written data were uploaded into a digital file so data could be transferred into a graph form for visual analysis. As recommended by Spriggs, Lane, and Gast (2014), the type of graph was reflective of the appropriate display of data for a multiple-probe across participants design. The graphic showed the participants’ performance data points for baseline, intervention, and maintenance in a line graph with dotted lines running vertically to indicate phase changes. Secondary observers attended an average of 34.4% of the sessions in each phase to verify procedural fidelity and reliability of recorded responses (Ayres & Gast, 2010).

Procedures

Quality indicators for single-case research design include operationally defining variables and procedures (Horner et al., 2005; Kratochwill et al., 2010; Ledford et al., 2014). See Table 6 for a layout of the procedures for each phase. All participants were assessed for baseline across six consecutive sessions (one session per day the student was on campus) to provide opportunity to demonstrate strong, stable baselines without demonstration of upward or downward trend (Gast & Ledford, 2014). A baseline session consisted of a randomly selected section of one of the three handbook sections. The baseline data were reviewed to determine which participant should begin intervention first. The participant with the most consistent and stable data was chosen to enter initial intervention. Intervention consisted of one session per day, with two to four sessions per week, depending on participant availability. To avoid the participant simply learning the correct answer to the question and to focus on assessing learning comprehension, intervention sessions were limited to a total of three sessions per handbook section. During the
third intervention session for one section, a baseline probe was taken for the next section to go into intervention. In the meantime, the remaining participants were placed on an intermittent probe schedule to prevent overexposure to the text (Gast et al., 2014).

Sessions took place at a consistent time based on each student’s availability. To strengthen internal validity, each participant session was held at the same time of day for that participant (Gast, 2014). Baseline sessions took approximately 7 minutes on average. Intervention sessions lasted between 15 and 30 minutes, depending on the participant.

Sessions were held in a one-to-one teacher to student ratio. The reading instruction took place primarily in the conference room of the preschool building. There were 2 days of sessions that took place in a lounge area outside of the conference room due to availability conflicts. The performance task took place in the natural environment of the task within the preschool building. For example, the intercom performance assessment took place at a phone nearest the reading instruction location. The handwashing sessions took place in the nearest bathroom or teacher’s lounge sink. For each intervention session, 5 pages of text, the equivalent of approximately one section of the employee manual, was read aloud to the participant using the text-to-speech function of the iPad®. After each page of text, a multiple-choice comprehension question was presented. Once the reading portion was concluded, the participant was taken to the appropriate preschool environment and the researcher asked the student to perform a task or skill related to the reading. If the task was performed correctly according to the steps laid out in the handbook, the data were recorded as correct. If the entire task was not performed correctly, the data were recorded as incorrect. General verbal praise for participation was given after each question was answered and at the end of each session.
Three versions of each handbook section were created with varying page and question orders in each section to avoid testing order effects (Gast, 2014). Before baseline and intervention sessions began, section versions were randomly selected by drawing numbers. No sections were repeated more than twice in a row. The number order was recorded for each participant. Three sections of the handbook were covered during this study: one section for each intervention phase. To reduce results based on memorization, each participant was moved to the next section of the handbook after three consecutive sessions, regardless of score. Table 4 lists the step-by-step procedures for baseline, intervention, and maintenance phases.

Before beginning baseline and intervention sessions, the participant was seated at a table with the unlocked iPad®. The interventionist sat next to the student in a location that allowed a clear view of the student responses to the comprehension questions. The student was then verbally prompted to begin by opening the preschool handbook. This was done by selecting the iBooks® icon on the iPad®. Once the application was opened, the researcher pointed to the appropriate book from a list of available books. The participant then touched that book to open the appropriate employee handbook section.

**Prebaseline Instruction**

All student participants were assessed on their basic iPad® familiarity before beginning in the study. Prior to baseline sessions, participants were given an iPad® and asked to navigate to the iBooks® application. Then they were asked to open a book in the application and demonstrate how to access different pages using a swiping motion on the screen. If they were unable to perform these tasks, participants were then taught how to complete any missing steps. Before moving to baseline, participants had to demonstrate 100% mastery of the iPad® navigation steps over three consecutive attempts.
### Table 4

**Procedure Table for Treatment Package**

<table>
<thead>
<tr>
<th>Study Conditions</th>
<th>Baseline Procedures (A)</th>
<th>Intervention (B)</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Adapted handbook written at lowered Lexile level (200-400).</td>
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<tr>
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<td>• Pictures to supplement understanding of text.</td>
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<tr>
<td></td>
<td>• Written and displayed in <em>iBooks</em>® format on an iPad®.</td>
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<td>• Written and displayed in <em>iBooks</em>® format on an iPad®.</td>
</tr>
<tr>
<td></td>
<td>• Comprehension question displayed in <em>iBooks</em>® after each page of text.</td>
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<td>• Comprehension question displayed in <em>iBooks</em>® after each page of text.</td>
</tr>
<tr>
<td></td>
<td>• Participant shown how to use the text-to-speech (VoiceOver) feature in the iBook.</td>
<td>• Participant instructed/reminded how to use graphic organizers regarding “wh” questions and how to use the VoiceOver tool.</td>
<td>• Graphic organizers placed in front of participant and reviewed.</td>
</tr>
<tr>
<td></td>
<td>• Participant listened to the text and then the text of the multiple-choice comprehension question.</td>
<td>• Participant listened to the text and then the text of the multiple-choice comprehension question.</td>
<td>• Participant listened to the text and then answered multiple-choice comprehension question.</td>
</tr>
<tr>
<td></td>
<td>• Systematic, least-to-most prompting used to correct errors in the comprehension questions.</td>
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</tr>
<tr>
<td></td>
<td>• Re-read strategy prompted: participant pressed “Check Answer” on comprehension question. If wrong, prompted to go back to the previous page and hit the “read aloud” feature again, listening for the answer to the question. Then ask the question again. If incorrect a second time, researcher intervened and took participant back to the specific section or sentence that included the answer to the question. If answered incorrectly again, the researcher read the answer on the</td>
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<td></td>
<td>• Participant then asked to perform a task related to the reading for that session.</td>
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</tr>
<tr>
<td></td>
<td>• Data was collected on number of correct comprehension questions and correct demonstration of performance task.</td>
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<td>• Data was collected on number of correct comprehension questions and correct demonstration of performance task.</td>
</tr>
</tbody>
</table>
Baseline

The purpose of the baseline or probe condition was to assess the current level of each student on the dependent variables as well as establish experimental control (Gast et al., 2014). Prior to baseline, the participants were taught how to open the appropriate iBooks® text, swipe through the pages, and make selections on the multiple-choice question widget. Baseline began after participants demonstrated 100% mastery of these skills in three consecutive attempts. During baseline sessions, the researcher worked one-to-one with the participant. The participant was given the unlocked iPad® and told to “Please open the Preschool Employee Handbook and I will begin reading. Answer each question the best you can and then go to the next page. We will follow these steps until you reach the end of the book.” After this verbal prompt, the participant had 10 seconds to open the text. The instructor then began reading through the text. If the student responded incorrectly or failed to respond within 10 seconds, the instructor completed the steps necessary to open the appropriate book or swipe to the appropriate page. The instructor then began the reading. At the end of the page, the instructor verbally prompted with “Swipe to the next page.” At each question, the participant was given 10 seconds to answer. If no response was
given within 10 seconds, the participant was verbally prompted to select an answer. All participants responded at this point of baseline. No further prompting was needed.

After completing the text for that session, the student was given a verbal prompt to complete a task related to the reading. If the student did not begin the first step within 10 seconds, the teacher verbally prompted one more time. After another 10-seconds wait time with no response, the session was ended. The researcher then thanked the student for her participation. This 10-second wait time occurred at the completion of each step in the task. If there was no response during that time, the instructor verbally prompted with “Are you finished?” If the student said, “yes,” then the session was ended. If the participant said, “no,” then the instructor gave the participant another 10 seconds. If the participant did not complete the step at this point, the session was ended and the participant thanked for her involvement. No error correction procedures or prompts were given for steps completed incorrectly. All participants followed baseline procedures for a minimum of 6 consecutive sessions (i.e., one session per day participant was on campus), which surpasses the recommended minimum of 5 baseline sessions (Kratochwill et al., 2011).

To minimize sequencing effects, the order and version of the handbook sections were randomly selected by drawing numbers. During the 6 sessions of baseline, each of the three handbook sections were assessed twice. At the end of the initial 6 sessions, data for all participants were assessed for stability in level and trend. The participant with the most consistent and stable data was then moved into the intervention phase (Gast et al., 2014). Per Gast and Spriggs (2014), stability is defined as 80% of the data points falling within or on 25% of the median for both level and trend. The remaining participants were placed on a probe condition schedule to avoid boredom and to control for testing effects (Gast et al., 2014).
Participants were probed on the appropriate handbook section in baseline condition again immediately before entering the intervention phase to aid in demonstrating immediacy of effect between the two phases.

**Intervention**

The independent variable for this intervention was a treatment package that included the following: (a) systematic instruction using least-to-most prompts for comprehension question error correction and re-reading procedures, (b) instruction and prompting to use the graphic organizers (see Figures 1 and 2) to guide participants in answering the questions correctly and using the VoiceOver tool, and (c) a read-aloud component using the built-in text-to-speech tool on the iPad® called VoiceOver. The *iBooks Author®* application has a quiz feature that allows the reader to check the answer to a multiple-choice question. If the answer was incorrect, the selection button turns from blue to red and text reading “Incorrect” would show up. If the answer was correct, the button would turn green and the text “Correct” would appear. When the participant had an incorrect answer during intervention, least-to-most prompting was used to encourage the use of the “wh” question graphic organizer and a re-reading procedure to obtain the correct answer. Least-to-most prompting, which was a more naturalistic way to transfer stimulus from the experimenter’s prompts to the natural environmental stimulus (Cooper et al., 2007), has been demonstrated as an effective method for teaching individuals with ID to use electronic devices (Kagohara, 2011; Wu, Wheaton, & Cannella-Malone, 2016).

During intervention, the participant was seated at a table with the iPad Air® and laminated copies of the graphic organizers displayed on the table. Before beginning intervention, the participant was taught to turn on the text-to-speech feature (VoiceOver) of the iPad®. Once the participant demonstrated 100% mastery of this step over three consecutive sessions,
intervention began. When one participant did not reach mastery on this component after 6 sessions, a modification was made. This participant did not demonstrate the motor skills needed to make the repeated taps on the screen to select an answer to the multiple-choice question. During the first session, the researcher physically assisted the participant with this phase. During subsequent intervention sessions, the Assistive Touch accessibility tool was implemented instead of just the VoiceOver. This allowed the participant to still hear the text read aloud, but only had to touch the screen once to make a selection, rather than the multiple, specifically timed taps needed to make a selection in VoiceOver mode.

At the start of the session, the instructor reviewed the purpose and content of each graphic organizer as well as the process of checking answers and swiping back to the previous page to review the text. The instructor then gave a verbal prompt to start the read aloud component on the iPad®. If the student did not respond or begin the step within 10 seconds of initial prompt, a system of least-to-most prompts was used to begin the read aloud.

If the participant did not respond to the comprehension question within 10 seconds of the answers being read, a verbal prompt was given to answer the question. If the question was answered incorrectly, the instructor prompted with "No, that isn't correct." Then the instructor drew the participant’s attention to the “wh” graphic organizer and pointed to the appropriate line of the organizer. The researcher would say something like, "Remember, Wh__ questions are looking for a ______. Let's go back and listen again." Then the instructor prompted the participant to listen to the previous page again. If an incorrect or no response was given to that step, the instructor stated, “No, remember, we need to swipe back to the previous page and read it again.” Least-to-most prompt procedures were followed for this step as well. If the participant answered incorrectly a second time, the previous step was repeated but only the correct section
was read aloud. If an incorrect or no response was given during the third attempt, the instructor would swipe back to the previous page, point to the answer in the text, and read it aloud. Then the instructor would swipe back to the multiple-choice question and model the correct answer. “The answer is _______. Your turn. You point to ______.” Then the instructor verbally prompted the participant to move to the next page.

After reviewing the section of text and answering the comprehension question related to the pages, the student participants were asked to perform a related skill. Correct responses were recorded only if each step listed in the text was performed accurately (see performance task step lists in Table 5). The instructor gave verbal praise for correct responses and for a job well done at the end of the reading session.

After the performance task was read aloud, the instructor gave a verbal reminder to the participant that she could look back through the text to help complete the task. The participant was then given 5 seconds to begin the first step. If no response or an incorrect response was given in the first step, the instructor gave the verbal performance prompt again. Least-to-most prompting was used to direct the student back to the iPad® text. If no response occurred after 5 seconds, the session was ended. If the student began the task but completed a step incorrectly, no error correction took place. The instructor took data on correct and incorrect steps over the total task. If the participant stopped working on the task before all the steps were completed, the instructor waited 5 seconds for her to resume. If no response occurred, the instructor asked, “Are you finished?” If the participant indicated that she was finished, the session was ended. If the participant responded with “no,” the instructor gave the participant another 5 seconds to move to the next step. All participants followed procedures appropriately and did not need reminders to stay on task or to complete their task.
This intervention was designed to improve listening comprehension skills. To avoid memorization of the answers to the comprehension questions, only three sessions per handbook section were implemented before moving to the next section. Each handbook section had three versions where the page orders and question answer order were varied between versions. Version order was randomly drawn for each participant before intervention started. Before intervention began on the next section, a baseline probe for that section was given. Data were visually analyzed daily for within and between data patterns regarding level, trend, variability, and immediacy of effect to monitor student progress, as recommended by Kratochwill et al. (2010).

**Maintenance and Generalization**

Maintenance probes for each handbook section were taken once a week after intervention was completed. These sessions were held at a consistent time of day to the intervention phase, based on individual participant availability. Participants were taken to the preschool setting and seated at a secluded table to review the handbook text from a randomly selected section and version. They could use the text-to-speech function of the iPad® and had access to the graphic organizers as in the intervention phase. They did not receive prompting to open and use the text-to-speech tool or the organizers. Unlike intervention, there was no error correction prompting during this phase.

Data were collected on correct answers to the comprehension questions and performance tasks. Data were also collected on whether participants followed the re-read procedure in the handbook if they answered a question incorrectly. This information helped determine whether the participant was able to generalize the practice of rereading for greater comprehension without prompting from the instructor. If participants were able to demonstrate this re-reading step during the maintenance phase, the potential to improve their level of independence when
engaging with text was increased. Percentage of correct responses to the comprehension questions and percentage of correct steps in the task analysis were recorded. The only prompt given was a verbal prompt to begin the reading and to begin the performance task. If the participant did nothing for 10 seconds, she was prompted with “Are you finished?” If the participant replied with a “yes,” the session was terminated and the student thanked for her participation. Sessions lasted approximately 15 minutes, as they did in the intervention phase. As many maintenance probes as possible were taken before participants left for winter break.

**Data Analysis**

The primary method of data analysis to determine whether there was a functional relation between the intervention and the participants’ comprehension of the texts was visual analysis. Data patterns regarding trend, level, variability, and immediacy of effect were reviewed and discussed (Kratochwill et al., 2010). The effect size was calculated using the Tau-U statistic (Parker, Vannest, Davis, & Sauber, 2010) to demonstrate the practical relevance of the study.

**Visual Analysis**

**Level.** The level demonstrates the central tendency of the data collected within a phase or condition. The varying levels of each phase were used to compare results. As recommended by Kennedy (2005), the level was reported as a mean of the data points within a phase condition. This was calculated by taking the average of the data points. When a significant change of level was reported, the percentage of change from baseline was indicated.

**Trend.** The data trend refers to the direction, either positive or ascending to flat to negative or descending, of the data points using a line of best fit. As recommended by Kennedy (2005), trend lines were calculated using the split-middle technique.
Variability. Variability is the difference the data demonstrates between each data point and the overall trend line (Gast, 2014). The range of 50% (25% above and below) around the trend line was created for analyzing the comprehension question responses. For each phase, the number of data points in the range were divided by the total number of data points and then multiplied by 100. This gave a variability indicator where a score of 80% or higher indicated stability and a score of lower than 80% indicated variability.

Immediacy of effect. As recommended by Horner (2015), immediacy of effect was determined by examining the magnitude of change between the last three to five data points in a condition or phase and comparing it to the first three to five data point in the subsequent condition or phase. The change in level, trend, or variability was discussed.

Research Design

This study consisted of a multiple-probe across conditions and participants design (Horner & Baer, 1978) to analyze the effects of a literacy treatment package, including text-to-speech function, graphic organizer, rereading strategy, and systematic prompting, on text comprehension across multiple sections of an adapted employee handbook accessed via an iPad Air®. This design provided the opportunity to demonstrate a functional relationship between the literacy package and text comprehension by allowing for an evaluation of the immediate change between baseline probe condition performance and performance after application of the intervention. The use of multiple-probe design allowed for the evaluation of the systematic prompting procedures for error correction and the use of the graphic organizer because participants were not as likely to learn and use those strategies and tools without implementation of the intervention. The use of multiple probe procedures rather than multiple baseline avoided assessing repetitive baseline condition data that were not likely to change; thus, preventing
boredom and/or frustration in the participants and controlling for testing effects that may have threatened internal validity (Gast, 2014).

The experiment consisted of baseline probe conditions, intervention, and maintenance and generalization phases. The probe condition included a minimum of five data probes so there were enough to demonstrate stability in the results (Kratochwill et al., 2010). Once stability was established in the last three data points, the participant with the most stable data was moved to intervention first. The handbook section was randomly assigned for each participant to control for order effects. Baseline data probes continued for the remaining participants on all three sections of the handbook while the first participant was in intervention at a minimum of every 5 probes and concurrently just prior to entering intervention (Gast & Ledford, 2014). After three sessions in intervention, the participants also had a baseline probe point collected on the subsequent phase section of the handbook.

To focus on the listening comprehension development and to avoid memorization of the correct answers to the questions, intervention for a section was ended after three sessions. A baseline probe was taken for the next section and then intervention for the next section of the handbook began. This process continued into the third handbook section. Using multiple sections of the handbook expanded the results of this experiment by providing an opportunity to demonstrate the functional relationship of the intervention and text comprehension across multiple participants as well as several sections of the handbook.

**Interrater Reliability**

Interrater reliability is the measure of degree that two observers report similar results when observing and collecting data on an event (Cooper et al., 2007). Interrater reliability data was collected by a second observer for a minimum of 20% of the baseline, intervention, and
maintenance sessions. The researcher and the second observer used the same type of data collection forms. The second observer recorded the number of correctly answered text comprehension questions as well as the number of task-analysis steps completed correctly in the performance task. Any disagreements were discussed following the session and either an agreement was made, or the item was marked as incorrect. The number of agreements was subtracted from the total number of agreements plus disagreements and that total was then multiplied by 100 to obtain the total percentage of agreements.

**Procedural Fidelity**

Procedural fidelity, which analyzes the degree to which a set of intervention procedures were followed with fidelity and therefore determines whether the experiment was implemented as it was intended (Cooper et al., 2007), was also recorded by a second observer for a minimum of 20% of the sessions, as recommended by Gast (2014). The observer was provided with a procedural fidelity checklist. A plus was marked for each step of the intervention followed correctly, and a minus was marked for each step missed. After each session, the second observer and the researcher reviewed the fidelity of procedures to ensure nothing was missed. The percentage of procedural fidelity was calculated by the number of correct steps subtracted from the total number of correct and incorrect steps and then multiplied by 100.

**Social Validity**

Social validity was then assessed using a post-intervention seven-point rating scale questionnaire designed to assess a wide variation in consumer response (Schwartz & Baer, 1991). The exception to this was the student survey, which was based on a three-point rating scale to avoid the confusion of having too many responses from which to choose. The survey was given to the student participants (the direct consumer), the program director (member of the
immediate community), and the preschool director (the indirect consumer) as recommended by Schwartz and Baer (1991) to appropriately assess the social validity of the intervention. The questions were designed to follow the guidelines given by Wolf (1978) and centered on (a) determining if the goals and procedures of the intervention produced were relevant to the anticipated/desired change; (b) if the procedures, materials, and techniques used were cost-effective, time-efficient, and reasonable to implement; and (c) if everyone was satisfied with the outcomes of the intervention and/or were there any negative side effects. The directions for the questions included a guideline regarding the period of time that consumers were rating (McMahon, 1984) and was very specific to the intervention so as to increase the usefulness of the information collected (Mash & Terdal, 1981). The researcher also collected field observations of whether the participants referred to the manual for support during the task analysis phase and if participants seemed engaged in the process.

Effect size was calculated using the Tau-U statistic (Parker et al., 2010). Tau-U allows the researcher to measure data non-overlap between two phases and provides standardized data needed for meta-analysis (Shadish, Hedges, Horner, & Odom, 2015).
CHAPTER FOUR: RESULTS

Competitive employment experience and person-centered planning are considered promising practices for postsecondary education programs for young adults with ID by leaders in the field (Hart et al., 2010). The ultimate goal of the postsecondary education program the participants of this study were involved in was to improve transition outcomes. One of these primary outcomes was employment. All four of the study participants were interested in gaining employment or internship experiences at the university preschool. This study provided an opportunity for the participants to prepare for potential work experiences at the preschool by spending time learning essential elements of the university preschool employee handbook. An understanding of the key policies and procedures of a workplace, such as those found in employee manuals or handbooks, are an important component to employment success (Inc., n.d.; National Federation of Independent Business, n.d.; U.S. Small Business Administration, n.d.). However, most students with ID do not have even minimal proficiency levels in reading and struggle with access to written texts (Katims, 2001).

Interactive shared story reading has been supported by research as an effective method to promote literacy skills for secondary students with moderate and severe ID (Hudson & Test, 2011; Mims, Hudson et al., 2012). Multicomponent reading programs have demonstrated effective improvements in a variety of literacy skills, including comprehension, for elementary students with mild ID (Allor et al., 2014) to moderate and severe ID (Browder, Ahlgrim-Delzell, Flowers, & Baker, 2012; Coyne et al., 2012). A review of the literature provided minimal research on improving the text comprehension skills of young adults with ID, so methods used successfully for younger students with ID were applied in this study. The results of this study
further contribute to the literature by using postsecondary students with ID and incorporating a real-world text such as an employee handbook.

This chapter reviews the results of this dissertation study. Interrater reliability and procedural fidelity data will be discussed first. Then the findings for each research question will be reviewed across participants and handbook sections.

**Interrater Reliability**

Reliability data were collected by a second observer during a minimum of 30% of the baseline, intervention, and maintenance conditions: 30% of baseline, 36% of intervention, and 67% of maintenance. The number of correct unprompted responses to the comprehension questions and the performance task were recorded by the second observer and then compared to the responses saved on the iPad Air® and the recordings of the researcher. Interrater reliability measured at 100% in all phase conditions.

**Procedural Fidelity**

Procedural fidelity data were collected by a second observer during a minimum of 36% of all phase conditions: 76% of baseline, 36% of intervention, and 67% of maintenance. Overall fidelity was rated at 100%. The primary researcher performed 83% of baseline, 81% of intervention, and 70% of maintenance sessions. The trained secondary researcher performed 17% of baseline, 19% of intervention, and 30% of maintenance sessions.

**Dependent Variables**

**Research question 1.** Does the application of a multimedia literacy treatment package improve the text comprehension of an adapted employee handbook for college students with ID?

Figure 3 displays the results of each participant’s progress on unprompted correct responses to both the comprehension questions and the performance task. All participants
received intervention in three sections of the preschool employee handbook. The order of presentation of each section was varied per participant to control for sequencing effects. Each participant received three sessions of intervention for each section to minimize the effects of memorization of correct responses and to provide sufficient time and opportunity to assess the intervention effects on each handbook section before the end of the semester. This limited number of sessions also reduced the potential for boredom or frustration for the participants. The reported mean and standard deviation data do not include baseline probes that were taken after the first round of intervention began (see Table 5). Because the intervention included rereading strategies and instruction on the contents of the “wh” organizer, baseline probes taken after the first phase of intervention had begun would potentially be influenced by the information provided during the intervention sessions. Although the researchers attempted to return to baseline conditions for those probe sessions, ultimately, the participants had been exposed to the concepts included in the graphic organizers and least-to-most prompting systems and their influence cannot be ruled out. The researchers decided that these baseline probe data points had the potential of skewing the overall results and chose not to include them in the data table.

Visual analysis was conducted on the level, trend, variability, immediacy of effect, and data consistency within and between phases. Guidelines set forth by Kratochwill et al. (2010) define a functional relation in multiple baseline research designs as a visible difference between the data points in the last three sessions of a phase and the first three sessions of a subsequent phase. The baseline patterns for remaining participants should also not change when the first participant begins intervention. Results indicated that the baseline patterns of Kate, Beth, and Olivia did not change after Nancy began intervention. Nancy, Kate, and Beth showed a functional relation between the last three scores in their baseline results and the first three scores
in intervention. Generalization data are displayed in the results of the multiple sections of the handbook. Maintenance data are shown as well. During the maintenance phase, participants had access to the graphic organizers and verbal prompts to begin the reading. They also received a verbal prompt to begin the performance task. After that, no further prompting was given. Results included the correct responses obtained during the first attempt per question. If participants subsequently corrected themselves, those results were not reflected in Figure 3 but were reviewed in the discussion of the data for each participant.

Tau-U statistics were calculated for the overall baseline and intervention phase contrast using the Web-based Tau-U calculator found on singlecaseresearch.org (Vannest, Parker, & Gonan, 2011). When calculating Tau-U, baseline trend was evaluated first to determine if correction was needed prior to completion of analysis. Vannest and Ninci (2015) recommend a general rule of baseline trends under 0.20 do not need correcting. When contrasting baseline scores for the participants in this study, correction was needed for Kate’s baseline (0.381). After correcting her baseline, analysis of the weighted average or aggregated effect size for all participants was completed (see Table 6). An overall Tau-U effect size of 0.59 was calculated, which may be considered a moderate change from baseline to intervention (Vannest & Ninci, 2015).
Figure 3. Number of correct responses to comprehension questions. BL = baseline, S1 = handbook section 1, S2 = handbook section 2, S3 = handbook section 3.
Table 5

Mean Number and Standard Deviation of Correct Unprompted Participant Responses Across Study Phases

<table>
<thead>
<tr>
<th>Participant / Handbook Section</th>
<th>Baseline</th>
<th>Intervention</th>
<th>Maintenance</th>
<th>Gains</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>All Participants</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>2.47</td>
<td>1.17</td>
<td>3.86</td>
<td>1.22</td>
</tr>
<tr>
<td>Section 1</td>
<td>2.33</td>
<td>1.22</td>
<td>3.67</td>
<td>1.15</td>
</tr>
<tr>
<td>Section 2</td>
<td>2.58</td>
<td>1.31</td>
<td>3.83</td>
<td>1.27</td>
</tr>
<tr>
<td>Section 3</td>
<td>2.44</td>
<td>1.01</td>
<td>4.08</td>
<td>1.31</td>
</tr>
<tr>
<td>Nancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>1.17</td>
<td>0.98</td>
<td>3.56</td>
<td>1.67</td>
</tr>
<tr>
<td>Section 1</td>
<td>0.50</td>
<td>0.71</td>
<td>3.33</td>
<td>1.15</td>
</tr>
<tr>
<td>Section 2</td>
<td>1.33</td>
<td>0.00</td>
<td>3.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Section 3</td>
<td>1.33</td>
<td>1.41</td>
<td>4.33</td>
<td>2.08</td>
</tr>
<tr>
<td>Kate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>2.14</td>
<td>0.89</td>
<td>3.67</td>
<td>1.00</td>
</tr>
<tr>
<td>Section 1</td>
<td>2.67</td>
<td>0.71</td>
<td>3.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Section 2</td>
<td>1.67</td>
<td>1.15</td>
<td>4.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Section 3</td>
<td>3.00</td>
<td>0.71</td>
<td>4.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Beth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>2.89</td>
<td>1.03</td>
<td>4.22</td>
<td>1.39</td>
</tr>
<tr>
<td>Section 1</td>
<td>2.89</td>
<td>0.00</td>
<td>5.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Section 2</td>
<td>3.00</td>
<td>0.96</td>
<td>3.67</td>
<td>1.15</td>
</tr>
<tr>
<td>Section 3</td>
<td>2.33</td>
<td>1.15</td>
<td>4.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Olivia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>3.25</td>
<td>0.82</td>
<td>4.00</td>
<td>0.71</td>
</tr>
<tr>
<td>Section 1</td>
<td>3.00</td>
<td>1.00</td>
<td>3.33</td>
<td>0.58</td>
</tr>
<tr>
<td>Section 2</td>
<td>3.67</td>
<td>0.58</td>
<td>4.67</td>
<td>0.58</td>
</tr>
<tr>
<td>Section 3</td>
<td>3.00</td>
<td>1.41</td>
<td>4.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Note. Gains = average gains from baseline to intervention.
Table 6

Effect Sizes for Baseline to Intervention Comparison

<table>
<thead>
<tr>
<th>Participants</th>
<th>Tau-U</th>
<th>Z-score</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nancy</td>
<td>0.80</td>
<td>2.53</td>
<td>0.01</td>
</tr>
<tr>
<td>Kate</td>
<td>0.60</td>
<td>2.01</td>
<td>0.04</td>
</tr>
<tr>
<td>Beth</td>
<td>0.54</td>
<td>1.94</td>
<td>0.05</td>
</tr>
<tr>
<td>Olivia</td>
<td>0.44</td>
<td>1.54</td>
<td>0.12</td>
</tr>
</tbody>
</table>

a Corrected baseline.

Each participant scored one point for every correct response to the comprehension questions. Each session had a possible 6 points, with 5 points for comprehension questions based on information provided in the text and 1 point for a performance task based on steps listed in the text. A total of three of the four participants reached at least 67% mastery of each section of the handbook. The fourth participant achieved that level in two of the three handbook sections. Figure 3 shows the scores for each session in baseline, intervention, and maintenance phases.

**Nancy.** Nancy’s data revealed an increase in correct responses during intervention \( (M = 3.56, \text{range} = 1-6) \) when compared to baseline phase \( (M = 1.17, \text{range} = 0-3) \). Each section of the handbook demonstrated an accelerating trend during intervention with an absolute level change of 2 to 4 for section one, 1 to 5 for section two, and 2 to 6 for section three. The overall relative change in level for intervention was 3 to 5. Nancy’s scores were variable for baseline and intervention phases and stabilized during maintenance. An immediacy of effect was noted between baseline and section one intervention with a score change from 0 to 2. Nancy scored 4 out of 6 for the remainder of the section. Initial scores for sections two and three dropped down to 1 and 2 respectively. Both sections demonstrated upward trends, however. Nancy scored
higher in each subsequent section, ending with a score of 6 out of 6 for section three. During maintenance, Nancy achieved a higher level than baseline and intervention ($M = 4.44$) and the overall trend stabilized. When broken down by handbook section, Nancy had a decelerating trend in her section three scores (from 6 to 4), a slightly accelerating trend in section two (from 4 to 5), and no trend for section 1 (remaining at 4 for all three sessions). Baseline scores for Nancy were somewhat variable, so there was overlap between the data in baseline and intervention. A Tau-U effect size for Nancy was calculated at 0.79, $p = 0.01$, demonstrating a strong change from baseline to intervention.

**Kate.** The data for Kate demonstrated improvements in level between baseline ($M = 2.14$) and intervention ($M = 3.67$). There was a slight drop in the maintenance phase ($M = 3.33$). Kate’s scores were somewhat variable throughout each phase with a range of 1 to 3 at baseline (relative change of 2 to 3), 2 to 5 at intervention (no relative change of 3.5 to 3.5), and 2 to 4 at maintenance (relative change of 3 to 4). Kate’s scores reached stability for section two of the handbook during maintenance. During baseline, the data revealed a slight accelerating trend, although the last two data points had stabilized at 3. There was no immediacy of effect between baseline and intervention, although sections two and three of the handbook data reveal accelerating trends. Kate’s scores demonstrated a decelerating trend during section one. Because section one was the final section during intervention, Kate’s overall intervention trend was decelerating. During maintenance, there was no overall trend reflected. Data was stable with no trend during section two of the handbook. Kate demonstrated a slightly accelerating trend in section one and decelerating trend in section three. Because of the variability and high level in Kate’s baseline scores, there was significant overlap in the data between baseline and
intervention. Tau-U was calculated, after baseline trend correction, at 0.60, \( p = 0.04 \). This could be considered a moderate to large effect.

**Beth.** Beth’s data revealed a steady increase in correct responses to the comprehension questions from baseline \( (M = 2.89, \text{range} = 1-4) \), intervention \( (M = 4.22, \text{range} = 2-6) \), to maintenance \( (M = 5.56, \text{range} = 5-6) \). Beth’s baselines scores were variable for the first four sessions and then stabilized during the remaining sessions, scoring between 3 and 4 correct responses per session. During each section of intervention, data reflected an accelerating trend (relative level change for section one = 4 to 5; section two = 3 to 5), with the strongest in section three (relative level change = 2 to 6). Beth’s scores were lowest during section two of the handbook, which was the final section she completed. This led to an overall decelerating trend during intervention. No immediacy of effect was noted between baseline and intervention, although correct responses improved by the final session of each handbook section. Beth’s scores were variable throughout baseline and intervention. Due to this variability, there was significant overlap of scores between baseline and intervention. Her scores reached stability during the maintenance phase, where she consistently scored a 5 or 6 out of 6. A Tau-U effect size was calculated at 0.54, \( p = 0.05 \), which may be considered a moderate effect.

**Olivia.** A slight increase in level of correct responses to comprehension questions was noted for Olivia between baseline \( (M = 3.25, \text{range} = 2-4) \), intervention \( (M = 4, \text{range} = 3-5) \), and maintenance \( (M = 4.67, \text{range} = 4-5) \). Baseline data were variable with an accelerating trend and a relative level change of 3 to 4. An accelerating trend was also noted during intervention, with a relative level change of 3.5 to 4. Section one demonstrated an accelerating trend (relative level change of 3 to 4). Sections two and three, however, demonstrated no data trend and remained stable at a level 5 and a level 4 respectively. No immediacy of effect was noted between baseline
and intervention phases. Only one session of maintenance data per handbook section was obtained because the semester ended. Because of the variability of the data and the minor increase in scores during intervention, there was a significant overlap of the data between baseline and intervention phases. The Tau-U for Olivia totaled 0.44, \( p = 0.12 \), indicating a low to moderate effect but without significance.

**Research question 2.** Does the application of a multimedia literacy treatment package, using an adapted employee handbook, improve related employment task completion?

The final recorded response for each section of the handbook involved a performance task. Correct responses to this task were measured by the participant completing each step of the task as listed in the handbook. Table 7 lists each task and the steps involved.

**Table 7**

*Task Analysis for Each Performance Task*

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of Intercom</td>
<td>1. Push the intercom button on the phone.</td>
</tr>
<tr>
<td></td>
<td>2. Dial 06 to call the Admin Office</td>
</tr>
<tr>
<td>Handwashing Demonstration</td>
<td>1. Use water</td>
</tr>
<tr>
<td></td>
<td>2. Use soap</td>
</tr>
<tr>
<td></td>
<td>3. Scrub for 20 seconds while singing ABC song.</td>
</tr>
<tr>
<td></td>
<td>4. Rinse</td>
</tr>
<tr>
<td>State Three Safety Rules</td>
<td>1. “We keep our bodies safe.”</td>
</tr>
<tr>
<td></td>
<td>2. “We keep our friends safe.”</td>
</tr>
<tr>
<td></td>
<td>3. “We keep our toys and materials safe.”</td>
</tr>
</tbody>
</table>
Unlike the multiple-choice comprehension questions during intervention, no error correction procedure was used for incorrect responses to the performance tasks. Participants were given a verbal reminder that they could look back in the text for help if they needed it before beginning the performance task during the intervention and maintenance phases. They were given no prompting during baseline. The performance tasks were broken down into steps within the text and data were collected on each step completed correctly or incorrectly during all phases of the study. Percentages of steps performed correctly per phase are shown in Table 8.

Table 8

Percentage of Task Analysis Steps Correct for Each Performance Task

<table>
<thead>
<tr>
<th>Participant and task</th>
<th>Baseline</th>
<th>Intervention</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nancy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercom</td>
<td>25%</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>Handwashing</td>
<td>58%</td>
<td>67%</td>
<td>67%</td>
</tr>
<tr>
<td>Safety Rules</td>
<td>0%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Kate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercom</td>
<td>33%</td>
<td>50%</td>
<td>33%</td>
</tr>
<tr>
<td>Handwashing</td>
<td>75%</td>
<td>75%</td>
<td>75%</td>
</tr>
<tr>
<td>Safety Rules</td>
<td>67%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Beth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercom</td>
<td>50%</td>
<td>83%</td>
<td>100%</td>
</tr>
<tr>
<td>Handwashing</td>
<td>56%</td>
<td>75%</td>
<td>75%</td>
</tr>
<tr>
<td>Safety Rules</td>
<td>0%</td>
<td>67%</td>
<td>100%</td>
</tr>
<tr>
<td>Olivia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercom</td>
<td>50%</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>Handwashing</td>
<td>69%</td>
<td>67%</td>
<td>67%</td>
</tr>
<tr>
<td>Safety Rules</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercom</td>
<td>41%</td>
<td>58%</td>
<td>60%</td>
</tr>
<tr>
<td>Handwashing</td>
<td>64%</td>
<td>71%</td>
<td>73%</td>
</tr>
<tr>
<td>Safety Rules</td>
<td>17%</td>
<td>67%</td>
<td>90%</td>
</tr>
</tbody>
</table>
The data in Figure 3 reflect the performance task as correct only when all the steps were completed successfully in a session. Overall, not one participant correctly completed all the steps in a performance task during baseline. As shown in Table 8, some steps within the tasks were completed correctly by the participants, but they never completed all the steps to any of the three tasks. The exception was the 3 Safety Rules task, where not one participant got any step correct at baseline. During intervention, a total of 10 demonstrations of the performance tasks were correctly completed across participants. Most of these were for the 3 Safety Rules task, which was within section three of the handbook (total of 8). The remaining correct tasks were performed on the Intercom task, which was within the handbook section one.

**Nancy.** Nancy had two opportunities to perform the Intercom performance task during baseline and was successful with the first step (e.g., pushing the intercom button on the phone) during the second baseline session. She maintained that same level of accuracy (i.e., step one correct) throughout intervention and maintenance, but never advanced to completing step two correctly. Instead, she would touch the intercom button, look expectantly at the researcher and then hang up the phone. She demonstrated all confidence that she had completed the task correctly. She did not return to the handbook text to check her work, even when verbally prompted before beginning.

During the first baseline sessions, Nancy completed steps two and four (e.g., use soap and rinse hands) in the order on the task analysis. She then advanced to completing steps one, two, and four correctly during the third baseline session. She maintained this level of accuracy throughout intervention and maintenance. She never completed step three (e.g., scrub for 20 seconds while singing ABC song). When she was prompted to look back in the text for the steps before she began, she would laugh at the suggestion and say she knew how to wash her hands. At
one point, she did mention that she was not going to sing the ABC song because that was “stupid.” She said she was not a baby and did not need to do that. Either way, she also did not scrub for 20 seconds. Over the course of the intervention, she appeared to be scrubbing longer periods of time, but she never reached 20 seconds.

During baseline, Nancy completed 0% of the 3 Safety Rules correctly. She had the opportunity to perform that task three times during baseline. As soon as intervention began, Nancy achieved 100% accuracy in those steps and maintained that mastery level throughout intervention and three maintenance sessions.

Kate. Kate did not complete any steps to the Intercom task correctly during the first session of baseline. During the second, she pushed the intercom button of the phone but did not dial the necessary extension. During the third baseline session, she switched her performance. She did not push the intercom button, but she picked up the phone and hit the two office numbers (i.e. step two). She continued this throughout intervention and maintenance. She would go back into the handbook to find the right numbers to dial, but she neglected to push the intercom button first. Kate’s handwashing results were similar to her peers. She completed steps one, two, and four correctly from baseline through intervention and maintenance. She did not complete step three. For this step, she never referred to the handbook either. For the third performance task, the 3 Safety Rules, Kate stated the first rule successfully on the first day of baseline. With each baseline session, she increased her level of correct response. By the third baseline, she stated all the rules correctly. She was the only participant to state any of these correctly during baseline. She maintained 100% mastery of these steps throughout intervention and maintenance.

Beth. From the first baseline session through the last session of maintenance, Beth completed step one of the Intercom performance task correctly. It was not until the second
session of baseline that she was able to complete the second step (i.e., dialing the office number). During that session, she went back into the handbook to find the steps of the task and to look up the number she needed to dial. Once she demonstrated step two with success, she maintained 100% accuracy on this performance task through the remainder of the study. She was the only participant to complete both steps of this task correctly.

Her results during the Handwashing task were similar to her peers. By the fourth baseline session, she completed steps one, two, and four correctly. Initially she would get soap first and then use water, thus reversing steps one and two. This may be the result of prior handwashing training where she was taught to get the soap before wetting her hands. She never referred to the handbook for the steps, but rather demonstrated great confidence that she was completing the task correctly.

For the third performance task, the 3 Safety Rules, Beth did not perform any steps correctly during baseline or the first session of intervention. During the second intervention session with this performance task, Beth looked back into the text to find the answer to the question. From that point on through the remainder of the study, Beth stated all three safety rules correctly. The first three times, she went back into the text to self-check that she was correct.

**Olivia.** From the first session of baseline, Olivia correctly demonstrated step one of the Intercom performance task. She maintained that accuracy throughout intervention and maintenance, but never successfully completed the second step. Instead, she would confidently press the intercom button, hold the phone earpiece, and look at the researcher for verification. When asked if she was finished at this point, she always stated “yes.”

During the Handwashing performance task, Olivia would occasionally flip the order of steps one and two (i.e., use water then use soap) similarly to Beth. This too may have been how
she was taught the procedure at an earlier time. She never completed step three (i.e., scrub for 20 seconds while singing the ABC song). In fact, she rarely scrubbed at all. Instead, she would get her hands wet, get soap, and as soon as she put her hands together to scrub, she would also rinse them off.

Unlike her peer participants, Olivia never completed any of the steps to the 3 Safety Rules correctly. Instead she would say “fireman,” “policeman,” and “ambulance” for the 3 Safety Rules. She did not refer to the text to check her work, and instead displayed confidence that these were the correct answers.

The steps to the Handwashing task were never completed as written in the text by any participant. Most were familiar with using water and soap and then rinsing when they were finished washing their hands. Two of the participants changed the order of this process throughout the phases of this study (e.g., got soap first and then water). None of the participants followed the third step of this task, which included scrubbing for 20 seconds while singing the ABC song. This was how the children of the preschool were taught to wash their hands, so the preschool director felt that this specific sequence was an important one for the study participants to learn. However, the participants did not transfer the reading of this step in the handbook into their performance of the task. This may be because of previous handwashing training that did not involve any such step, or perhaps, a feeling that singing the ABC song was not age appropriate.

Social Validity

Research question 3. Was the multimedia literacy treatment package and adapted employee handbook considered an effective method for increasing understanding of important employee concepts by the students, the program director, and the employer?
Evaluating the social importance of an intervention is essential to the measure of importance given to the results of an intervention (Baer, Wolf, & Risely, 1968). Each participant was asked to complete a social validity survey following the completion of all phases of the study. A secondary observer, with no previous influence over the participants, read the survey questions to the participants. The participants circled their responses to each statement. They verbally gave their answers to the open-ended questions and the secondary observer wrote down their responses. Surveys were also given to the postsecondary program coordinator and the preschool director. Surveys took fewer than 5 minutes to complete. Results are shown in Tables 9 and 10.

Table 9

Summary of Participant Social Validity Surveys

<table>
<thead>
<tr>
<th>Survey items</th>
<th>Participants</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I learned to use the graphic organizer to answer</td>
<td>Nancy</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>questions about what we read.</td>
<td>Kate</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>I learned to use the text-to-speech (VoiceOver) tool</td>
<td>Beth</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>on the iPad.</td>
<td>Olivia</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>I worked one-on-one with a teacher for this project.</td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>The teacher asked me questions when I wasn’t sure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>about an answer.</td>
<td></td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>We used picture charts to answer questions.</td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

Note. Scores were based on a range of three choices (I like this = 3, I’m not sure = 2, I didn’t like this = 1).

The participant survey was based on a three-point rating scale to avoid the confusion of having too many response choices. Responses also included a happy face (“I like this”), questioning face (“I’m not sure”), and sad face (“I didn’t like this”) emoticons that correlated
with the answer choices. Survey interviews took place once maintenance sessions were completed. To reduce potential bias, the participants were individually interviewed by the secondary observer. The participants’ responses ranged between a score of 2 and 3. Overall, the items were primarily rated as a 3 or “I like this” (90%). The two items rated the lowest were “I learned to use the graphic organizer to answer the questions about what we read” \((M = 2.75)\) and “The teacher asked me questions when I wasn’t sure about an answer” \((M = 2.75)\). The remaining statements were all rated at a 3 or “I like this.”

Three open-ended questions were also asked at the end of the survey. These included what they liked the most about the experience, what the worst part of the experience was, and what they learned. Nancy stated that she enjoyed “getting the questions right – that’s what I liked most.” To her the worst part of the study was that she had never tried it before, but also that there was “no worst part.” When asked what she learned from the project, Nancy stated, “The different types of jobs they were talking about” and that she “liked learning about it.” Kate liked the questions most and when the questions were hard the least. She stated that she learned “to wash my hands” from this project. What Beth liked most was that she now knew the steps to the handbook. She felt that the worst part of the study was that the questions were too easy. When asked what she learned, she stated “How to wash my hands while singing the ABCs.” Olivia said that what she liked most about the study was learning the handwashing procedure. She said “nothing” was the worst part and that she “learned about the safety rules.”

Social validity was then assessed with other stakeholders using a seven-point rating scale questionnaire as recommended by Schwartz and Baer (1991). The survey was given to the program director (member of the immediate community) and the preschool director (the indirect consumer). Results are noted in Table 10.
### Table 10

**Summary of Stakeholder Social Validity Surveys**

<table>
<thead>
<tr>
<th>Survey items</th>
<th>Stakeholders</th>
</tr>
</thead>
<tbody>
<tr>
<td>The intervention was easy to follow and was appropriate for teaching the desired skill.</td>
<td>Program director: 6, Preschool director: 7</td>
</tr>
<tr>
<td>The text used was appropriate for the participants.</td>
<td>Program director: 7, Preschool director: 7</td>
</tr>
<tr>
<td>My students/future employees/ The participants gained important skills from this intervention.</td>
<td>Program director: 6, Preschool director: 7</td>
</tr>
<tr>
<td>This intervention was not too time-intensive or expensive to implement.</td>
<td>Program director: 6, Preschool director: 7</td>
</tr>
<tr>
<td>I would recommend this intervention to others.</td>
<td>Program director: 6, Preschool director: 7</td>
</tr>
</tbody>
</table>

*Note.* Survey scores were based on a 7-point Likert-type scale (7 = *strongly agree*, 6 = *agree*, 5 = *somewhat agree*, 4 = *neither agree nor disagree*, 3 = *somewhat disagree*, 2 = *disagree*, 1 = *strongly disagree*).

The stakeholders’ responses ranged between agree and strongly agree for all survey statements. Both strongly agreed that the text used was appropriate for the participants. At the end of the survey, stakeholders were asked if they had any additional comments or concerns regarding the intervention. The program director stated that it was “probably a little time intensive to make book. With book glitches, it would be hard to give to a student independently.” The preschool director stated that there was “strong evidence that with modification, this study/intervention could be beneficial for employment.”
Field Observations

Wolf (1978) recommends three measures of social validity: socially important goals, socially acceptable procedures, and socially significant effects. This section will review extended measures collected via field observations that speak to the social validity of the intervention. These include the amount of time the intervention took as well as the associated tools and generalizable skills that were gained during this study.

A measure of the social importance of this study was connected to the ability of the participants to perform the performance tasks based on the information in the text. This information was analyzed to assess whether comprehension of the text translated to real-life application. The participants were not prompted to correct any errors in the steps of the performance task, but were verbally reminded before they began the task that they could refer to the information in the handbook to help them. Three of the participants followed this advice for the intercom performance task and the 3 safety rules. No participants used this to refer to the steps for handwashing. A reason for this may be that the participants were each shown explicitly how to wash hands earlier in their lives and, because there was no error correction procedure for this step, they did not think they were doing anything wrong. Because the steps to handwashing were explicitly laid out within the handbook to model how they perform the task at the preschool (with the preschool students), the steps included “Scrub for 20 seconds while singing ABC song.” Not one participant ever completed this step during any phase of the study. Nancy mentioned at one point that she was “not going to sing ABCs” because that was “stupid.” The other three participants never seemed to notice that they were not completing that step. Instead, they all confidently performed the task believing they were doing it correctly. Since there was no error correction process for the performance task, they were not aware that they missed that step.
At the end of all phases, the participants were shown the missing component of their handwashing process. The researcher demonstrated the missing step and then explained why this was an important component for the participants to include at the preschool.

A measure of the socially acceptable procedures for this study included the minimal amount of time needed per session. The average time spent on a session during baseline was 8.06 minutes. During intervention, average session time was 16.9 minutes. In maintenance, no error correction procedure was used, so the average time per session dropped down to 7.53 minutes. All sessions were completed at the preschool in either their conference room or staff lounge area. This allowed participants to access the phone system and bathrooms used in the workplace as well as opportunities to gain familiarity with the building and the staff. All these elements could potentially help study participants make a smoother transition to working at this facility.

A measure of socially significant effects included the gains the participants made in using the technology, including the VoiceOver tool on the iPadAir®. This tool can be used to read text aloud on any Apple® device. Three of the four participants mastered the use of this tool, even troubleshooting when the read aloud did not complete the page. Kate struggled with the fine motor skills needed to access VoiceOver using the traditional method, so she was taught to use the assistive touch tool built into the iPadAir® to read the screen. She continued to need a minimal amount of assistance with navigating that tool throughout the intervention and maintenance sessions, but she completed the steps needed to start the read aloud with fewer than two prompts per session.
CHAPTER FIVE: DISCUSSION

The purpose of this dissertation study was to determine the effects of a multimedia adapted employee handbook using speech-to-text technology on the text-dependent listening comprehension of college students with moderate ID. A multiple-probe across participants and handbook sections was used to examine the impact of the independent variable on the dependent variables. The dependent variables included correct unprompted responses to the comprehension questions and performance tasks for each section of the handbook.

The treatment package was built on the work of Devine, Baker, Wennerlind, and Nasir-TuckTuck (submitted) and Mims, Hudson et al. (2012) and included the use of three of the seven NRP (2000) recommended methods to teach comprehension: (a) comprehension monitoring, (b) graphic organizer, and (c) question answering with immediate feedback. The comprehension questions were taught during a read-aloud of an adapted employee handbook and contained questions based on literal recall (three per section), analysis (two per section), and application (the performance task, one per section). The performance task data were the second focus of this study. For this question, the researchers examined the effect of the treatment package on the participants’ abilities to demonstrate an employment task related to text in the handbook. The third focus of this study was to evaluate the social validity of this literacy package as perceived by the participants and other direct and indirect consumers affected by the study.

The participants of this study were college students participating in a postsecondary education certification program on the university campus. Each had a diagnosis of ID per program director and/or student disclosure and scored at or below third grade levels of reading comprehension on the Informal Reading Inventory (Burns & Roe, 2002). All four demonstrated the physical ability to access the iPad® application and were interested in interning at the
university preschool. All participants were their own legal guardians and gave signed informed consent to participate in the study. Any names discussed were pseudonyms to protect anonymity.

The remainder of this chapter will discuss results of the intervention as it pertains to each research question. Data include numbers of correct unprompted responses to the comprehension questions and performance tasks, social validity survey findings, as well as observational data collected during the study. Contributions to the literature, limitations, implications for practice, and suggestions for future research will also be examined.

**Intervention Effects**

The following outcomes were found for the first research question, “Does the application of a multimedia literacy treatment package improve the text comprehension of an adapted employee handbook for college students with ID?” The findings of this study revealed a functional relationship between the multimedia treatment package and the number of unprompted correct responses to text comprehension questions for three of the four participants. The participants all made gains in their correct responses. It should also be noted that all the participants improved in their ability to independently navigate the text and use the VoiceOver accessibility tool; thereby increasing their level of independence in their navigation of the text. During maintenance, the system of least-to-most prompts was not implemented, and two participants continued to increase (Beth) or maintain (Olivia) their number of correct responses to the comprehension questions when compared to baseline and intervention phases. Kate demonstrated a slightly lower level during maintenance than intervention, but still higher than baseline levels. Nancy demonstrated a decelerating trend during maintenance when compared to intervention, but her maintenance level was higher than baseline.
The second research question focused on the relationship between the multimedia treatment package and the completion of related employment tasks described in the adapted handbook. The study findings did not reveal a functional relationship between the treatment package and the number of correctly completed performance tasks as a whole. However, when broken down by handbook section, there was a functional relationship between baseline and intervention for the section three performance task (i.e., the 3 Safety Rules). The preschool director indicated that the ability to state these safety rules were essential to working with the children at the preschool. All the participants were able to clearly state each safety rule by the end of the intervention phase.

Most of the steps to the handwashing performance task were completed by all participants during baseline through maintenance. This may be due to the participants’ previous experiences and training in some version of a handwashing procedure throughout their schooling. Because they were all confident in handwashing, they did not pay close attention to the specific steps listed in the handbook. The step they consistently missed was “scrubbing for 20 seconds while singing the ABC song.” This step was included in the handbook because the preschool director stated the employees needed to model appropriate handwashing to the young children in their care, and this was how they did it. Although the participants did not implement this step during intervention and maintenance, once the study was ended, the researcher explained what they had been missing and why it was important. The participants were all able to demonstrate that missing step with this minor explanation and error correction. Future research should implement an error correction procedure for the performance tasks as well to avoid this issue.
The participants quickly began to complete one step of the third task, using the intercom, during baseline and carried it through intervention; however, only one participant (Brenda) correctly completed the second step of this task by the end of intervention and into maintenance. It is important to note that they all gained a basic understanding of the use of the intercom during the readings. With some minor supports and corrective feedback, the participants would most likely complete both steps of the task with success.

The third research question focused on the social validity of the intervention and whether the primary and indirect stakeholders considered the handbook training an effective method for increasing literacy and understanding of important employee information. The findings of this study were that the participants liked the procedure, the text on the iPad®, and the information they learned. The additional consumers such as the preschool director and program director strongly agreed that the text was appropriate, and agreed or strongly agreed that the participants gained important skills and would recommend this intervention to others.

**Multicomponent Treatment Packages**

The results of the use of a multicomponent literacy treatment package such as that incorporated in this study can be compared to similar studies used to improve the text comprehension skills of middle school students with significant cognitive disabilities (Mims, Hudson et al., 2012), literacy skills of elementary students with moderate to significant ID (Allor, Mathes, Roberts, Jones, & Champlin, 2010; Browder, Lee, & Mims, 2011; Spooner et al., 2015), and text comprehension of high school students with moderate to significant ID (Kemp-Inman, 2017; Shurr & Taber-Doughty, 2017). These findings are also consistent with the research on read alouds or shared stories, which has been supported as a research-based practice
for text comprehension for students with significant cognitive disabilities by Hudson and Test’s (2011) systematic review of the shared story literature.

The results are also consistent with the findings of Shurr and Taber-Doughty (2017) and their use of a read aloud combined with pictures and a discussion of a variety of age-appropriate texts such as newspaper articles, employee handbooks, and leveled expository texts to improve the comprehension abilities of four high school students with moderate to significant ID. All participants showed improvement in their story retell, with two participants showing marked improvement. Shurr and Taber-Doughty noted that the use of more than one measure for comprehension was important for this population as they found discrepancies between participants answers to literal multiple-choice questions and their story retell points. The current study used both the literal multiple-choice questions for assessment as well as an application-based performance task to gain a better picture of comprehension. The results of this study align with Shurr and Taber-Doughty in that although gains were made in both assessments, there were definite differences in improvement between the two. The participants in the current study made steady gains in their correct responses to the multiple-choice questions, but stalled in their progress in the performance tasks. Most of the participants struggled with applying the verbal prompt of “look back in the text to help you” to their performance tasks. Instead they frequently stated that they knew what to do, even if they did not follow the steps as listed in the handbook.

These results, overall, support the findings of similar studies on the use of comprehensive literacy treatment packages for the listening comprehension of individuals with mild to moderate ID. Previous studies measured unprompted correct responses to a variety of comprehension questions (Browder et al., 2007; Mims, Hudson et al., 2012; Shurr & Taber-Doughty, 2017). As in previous studies, the findings of this research suggested that youth with ID can improve their
text comprehension through systematic instruction and overall access to adapted texts through shared stories; however, this study extends the literature by including a performance task based on the text and the use of the accessibility tool (VoiceOver) built into the iPad®.

**Technology**

In addition, the results of this study support previous research on the use of handheld technology devices to improve access and engagement to age-appropriate texts for youth with ID (Rivera et al., 2014; Spooner et al., 2015). The results also support the application of several components of multimedia instruction, such as limited text, purposefully placed pictures that highlight important topic areas, and interaction with the technology (Mayer, 2009).

The use of UDL in the design of the text was also supported. Components of UDL include multiple means of representation, multiple means of expression, and multiple means of engagement (Rose & Meyer, 2002). In this study, multiple means of representation included the text adaptation (lowered reading level), read aloud component, enlarged font size, and picture supports embedded in the text. The multiple means of engagement components were addressed in the direct participant interaction with the text in the use of the VoiceOver tool and the widget tool (to answer and check responses to comprehension questions). This area was also addressed in the use of a text that could potentially help the participants achieve their employment goals. Multiple means of action and expression were incorporated through the flexibility of the VoiceOver tool, which the participants could turn off at any point or replay when needed. The participants also had to touch the iPadAir® screen to select answers to the comprehension questions, which allowed for greater interaction with the text. Participants had to engage in a performance task where they could demonstrate their understanding by modeling a skill rather than simply picking from a set of multiple choice answers, which added to their overall
engagement with the text. These findings add to the literature that supports the use of handheld technology to teach a variety of functional and academic skills to young adults with ID (Burckley et al., 2015 – shopping; Cannella-Malone et al., 2012 – table washing and vacuuming; Creech et al., 2013 – math; Hart & Whalon, 2012 – science).

Prompting Hierarchy

The use of the least-to-most prompting system combined with the graphic organizer for the “wh” questions aligned with the instructional scaffolds recommended by NRP (2000) to teach comprehension to students without significant cognitive disabilities. The least-to-most prompting system, as a component of systematic instruction, has significant evidence in the literature to support its use as an instructional tool for students with ID (Browder et al., 2014; Miller & Test, 1989). The prompting hierarchy used in this study was similar to that used in Mims, Hudson, and Browder (2012) and Hudson (2013) and aligns with the “wh” question graphic organizer. When a participant answered a multiple-choice question incorrectly the first time, they were then verbally prompted with “No, that isn’t the right answer. Let’s look at the question. (Interventionist read the question again.) That is a (e.g., What) question.” The interventionist would then point to the appropriate question type on the graphic organizer and say, “Remember, for a (What) question, we listen for a (thing).” The participant was then prompted to return to the previous page and listen to the information read aloud again. This instructional scaffold supported the reread as well as future reading. At the second incorrect, participants were given the same set of prompts as the first round, but then directed to listen to the specific paragraph that held the pertinent information.
Repeated Reading

The findings of this study also support the use of a repeated reading strategy in improving text comprehension for students with ID. Hua, Thierren, et al. (2012) used a repeated reading strategy to present a text multiple times to improve the text comprehension for young adults with cognitive disabilities. Browder, Lee, and Mims (2011) used a rereading strategy as part of their error correction procedure with three elementary students with severe ID. All three students increased their level of correct responses as well as engagement in the activity. Mims, Hudson, and Browder (2012) used a rereading strategy with middle school students with significant ID and autism where students would be directed to re-read or listen to the previous page of text if they got the answer to a comprehension question wrong. All participants improved in the number of correct responses to questions about the texts.

During this dissertation study, 62% of multiple-choice questions that were initially answered incorrectly, were then answered correctly after the first round of re-reading. This meant that after implementing the first round of the least-to-most prompting hierarchy, the majority of the participants were able to answer the multiple-choice question correctly. This indicated that the review of the graphic organizer and the opportunity to listen to the text another time after knowing the question, led to a high rate of correct responses. The process of re-reading the text and listening for specific information is an important skill in the development of comprehension strategies.

Generalization Training

Multiple exemplars are one way to assess the listening comprehension skills of participants rather than simple memorization. In this study, a multiple probe across materials and participants design was used to evaluate both the effects of the intervention across participants as
well as the generalization effects across handbook sections. Hughes, Harmer, Killian, and Niarhos (1995) defined multiple exemplar training as teaching via the use of multiple examples of desired responses to improve generalization of the skill. Chezan et al. (2012) found the use of general case programming using multiple exemplars significantly improved the ability of a young adult with ID (age 21) to locate information on college course syllabi as well as access and use information via technology. The research findings of the current study demonstrated that the skills did not generalize directly to the next section for Nancy and Beth, as demonstrated by their abrupt drop in correct responses once a new section was introduced. Kate also showed a decelerating trend across the three handbook sections. Olivia did demonstrate some generalization in her higher section two scores during intervention; however, her baseline scores were rather variable and sometimes quite high.

Maintenance data demonstrated some support for generalization across all the participants, in that, they maintained and sometimes increased (Beth) in their progress during this phase where they were asked to proceed through each handbook section without any prompting for error correction. Future research should include a formal generalization process that includes probes on additional unfamiliar texts or sections of the handbook to completely assess for generalization. Per field observations, participants did generalize the procedure of accessing the read aloud, checking their answers in the widget, and swiping back to implement the repeated reading strategy. They were all able to navigate these components with very minimal prompting.

**Performance Tasks**

Employment outcomes for young adults with ID are consistently among the lowest reported (Migliore et al., 2009; Siperstein et al., 2013). One of the evidence-based predictors of postsecondary employment success for youth with disabilities is career awareness (Mazzotti et
Exploring an employee handbook gave these participants an opportunity to expand their career awareness in an area that they had expressed a basic interest. The purpose of the performance task in this study was to assess whether the participants could translate the information laid out in the text in a step-by-step format to real-life application. If a functional relation was found, then the use of the adapted handbook with this population was further supported. No research studies could be found that looked specifically at adapting employee handbooks for individuals with ID. Previous studies looked at the use of adapted grade-level texts for elementary and secondary students with moderate to significant cognitive disabilities (Mims, Hudson, & Browder, 2012; Mims, Lee, et al., 2012), but none addressed young adults and employment-based texts.

The findings of this study add to the literature that supports the use of a literacy treatment package that includes read aloud, text adaptation, graphic organizers, and a prompting hierarchy on the text comprehension of young adults with ID. The results of the performance task, however, show minimal support. Of the three performance tasks studied, only sections one and three obtained any correct responses. In section two (Use of Intercom), Beth completed the task correctly on the second and third intervention sessions. She maintained this accuracy during maintenance probes as well. However, not one of the other participants reached success on this task.

Section three (3 Safety Rules) was completed correctly by three of the four participants by the end of intervention. Nancy and Kate stated the 3 Safety Rules during the first session of intervention and maintained that level of accuracy through the remainder of the three intervention sessions and three maintenance probes. Beth did not respond to that performance task correctly in the first session of intervention, but she did during the second session and every
subsequent attempt. Olivia was the only participant to not achieve a correct response on this task. She maintained that the 3 Safety Rules consisted of “police, ambulance, and fireman.” These are important providers of safety, which Olivia may have been taught throughout her life, but they did not reflect the information provided in the handbook text.

It is also important to note that no participant completed the handwashing task appropriately. This may be because the students had all been taught a version of this skill throughout their school careers, which may have affected their belief in their knowledge of the steps to this performance task. If they believed they already knew how to complete the task correctly, then they did not need to listen closely to the information provided in the text. Had error correction been provided for the performance task, these issues would most likely have been quickly resolved during intervention. Future research should include an error correction procedure, much like that provided for the multiple-choice questions, as well as adding video modeling or interactive video supports. Evmenova and Behrmann (2012) used interactive video to improve their correct responses to factual and inferential questions of a text for six postsecondary students with ID. Evmenova et al. (2011) found that the use of a search tool within an interactive video was effective in improving the comprehension scores of the five adult students with ID. Cannella-Malone et al. (2012) used video prompting with error correction to successfully improve the acquisition of table washing skills for secondary students with moderate to profound ID. Kelley et al. (2013) had even more success with video prompts to teach pedestrian navigation skills to four college students with ID. An interactive video component may be a very effective addition to support the performance task skill.
Social Validity Findings

The social validity guidelines provided by Wolf (1978) focus on three areas, which will be reviewed in the following section. The first area centers on whether the goals and procedures of the intervention were relevant to the desired change. The desired change for this study was to see improvement and/or mastery of the text comprehension of the employee handbook so the participants could really improve their understanding of the rules to be successful in the workplace. Overall, this goal was achieved. The increase in correct responses to the multiple-choice comprehension questions as well as the correct performance of one of the performance tasks demonstrated effective procedures. Although the participants did not successfully transfer the information in the handbook into total complete performance for two of the tasks, they demonstrated some gain in certain steps of each task. No prompting hierarchy was used to assist in error correction of this step, which may have led to the participants’ lack of success. Future research should include a least-to-most prompting hierarchy for error correction in the performance task as well. The next step to assess this social validity component would be to collect data on the participants’ performance of these skills when they are officially working at the preschool. The preschool director suggested that a few modifications to this intervention would make it very beneficial to employment success and strongly agreed that the participants gained important skills from this intervention.

The second focus area was on whether the procedures, materials, and techniques used were cost-effective, time-efficient, and reasonable to implement. This study was conducted by the researcher and each participant in a one-to-one setting. The only cost involved was the iPad® and a few color copies of the graphic organizers. An additional interventionist was used for a little more than 30% of the total sessions. This procedure was easy to use and demonstrated a
very high fidelity across interventionists and handbook sections. This is important to note because being able to quickly and easily teach the necessary skills and to provide the intervention then have a greater potential for use by others. There were significant issues with the technology tools itself, however. The use of the iBook™ program was not as user-friendly as other systems such as PowerPoint™ or Adobe Presenter®. Although Apple® stresses the ease of their accessibility features, additional typing of text into the accessibility tool needed to be used to ensure that VoiceOver actually read all of the necessary information.

It is also important to note that when VoiceOver was activated, the handbook itself became much harder to navigate. An additional graphic organizer and training step had to be added into the intervention to teach the participants how to access the information and the tools needed. Kate did not have the fine motor skills to “tap twice” quickly enough for multiple-choice answer selections to register in VoiceOver mode. Assistive Touch and screen reader had to be activated so that she could access the read aloud and navigate the text as needed. Several times the iBook™ would suddenly close and have to be reopened during the intervention session. During a few sessions, music suddenly began to play where the researcher had to intervene and re-set the book. This led to a lack of independence for the participants in navigating the handbook. Future research should explore the use of other presentation options where the text-to-speech tools could be used without the need for additional personal assistance.

The third and final evaluation component recommended by Wolf (1978) consisted of whether everyone was satisfied with the outcomes of the intervention and/or were there any negative side effects. Overall, the participants and direct and indirect consumers of this intervention were satisfied with the results of the intervention. The participants overwhelmingly liked the interaction with the text and stated they liked the procedures they had learned. The
program director agreed that the intervention was effective but was concerned with the amount of time it takes to create the adapted text as well as the numerous glitches in the technology that occurred preventing independent access to the materials. The preschool director strongly agreed that the intervention was effective and important for employers. She stated that a few modifications should probably be made to increase outcomes, but she was pleased with the results of this study. All the participants made gains in their comprehension of the material, which is essential to the purpose of this study. Not all performance tasks were learned through the intervention, but all participants were shown how to perform the tasks correctly after maintenance was completed. All four participants were told what step(s) they had missed and why during the postintervention debriefing.

Future research should include least-to-most prompting for the performance task as well as the multiple-choice questions. Had that been implemented during intervention, the participants would have completed that final element correctly before intervention ended. The participants also learned how to use the VoiceOver tool within the iPad®. Accessing this text-to-speech tool is a skill that could easily be generalizable to any other text within an Apple® device, thereby potentially increasing independence for young adults with ID. The downside to using this tool was the difficulty participants found in navigating the pages of the text. This caused some minor frustration for the interventionists and the participants. The upside of this was that all the participants learned how to trouble-shoot when the reading did not go as it should. Every one of them independently re-set the read aloud as needed by the end of the first intervention phase. These were promising side effects of the study that should be explored in future research on independently accessing and troubleshooting handheld technology for young adults with ID.
Limitations and Suggestions for Future Research

Several limitations were noted and should be considered from the results of this study. First, the small number of participants inherent in single case research leads to limitations in generalization. However, it is important to note that this adds to the increasing number of studies on the use of shared stories to provide access to age appropriate texts (Hudson & Test, 2011; Snyder et al., 2017). Currently there are 14 single-case research studies on shared stories (read alouds) for students with moderate to significant cognitive disabilities that fit Horner et al.’s (2005) quality indicators of single case research design. An evidence base has been established for this method of teaching comprehension for elementary and middle school students with severe disabilities according to Horner et al.’s definition of evidence-based practice: more than the minimum of five single-subject studies that meet minimal criteria, including research conducted in at least three different regions by different researchers (10 different groups of researchers), and include a minimum of 20 participants (47 participants included in these studies). However, this study extends this evidence base to young adults with moderate ID, a population that varies slightly from many of those included in previous studies of shared stories.

A second limitation included the variability in the data. According to the quality indicators within single-subject research by Horner et al. (2005), the baseline phase should include a pattern of response that predicts future performance if no change in intervention occurred. The baseline data within this study demonstrated variability for all participants and was therefore difficult to establish baseline equivalency. Some of the high scores participants received during baseline could be due to the fact that an evidence-based practice (read aloud) was implemented during that phase. However, the researcher chose to proceed to intervention without waiting for significant stability in the data to reduce the opportunity for memorization of
the materials through repeated readings. Waiting longer for the baseline data to completely stabilize would also significantly reduce the possibility of finishing the intervention and maintenance phases before the end of the semester. It is important to note that, although variable in baseline, stability was reached by the maintenance phase for all participants.

A third limitation was the schedule of the study. Because of the schedules of each of these college students, they were not on campus for 5 consecutive days per week to collect data. Nancy and Beth were available for data collection on Mondays through Thursdays. Kate was not on campus on Tuesdays, so her schedule was Monday, Wednesday, Thursday, Friday. Olivia was only on campus Mondays and Wednesdays, so she always had a break in her exposure to the interventions. This may explain some of her lack of significant improvement over the course of the study. These conditions are the reality of working with this population, however. College student schedules vary significantly. Consistent schedules for each participant were set, however.

A fourth limitation was the type and adaptation of the text used. An employee handbook may be seen by some as an inappropriate text because many people may not actually read their employee handbooks. Therefore, using time and resources to apply this intervention to young adults with ID may not be the most efficient use of their time. However, an employee handbook is an age-appropriate text for this group of participants. It is a text they will be expected to follow in the workplace setting and is frequently referenced to maintain employee success. It is a text that is frequently written at a very high reading level and is therefore difficult to understand for preprimer readers. Although time-intensive to adapt for this intervention (because of this, only portions of the handbook were adapted), if success is demonstrated with these types of adaptations, employers and vocational rehabilitation agencies may be encouraged to provide more accessible handbooks for all employees.
The adaptation itself is a subjective measure. To counter for this subjectivity, the adapted text was evaluated by a panel of experts in instruction for students with significant cognitive disabilities and multimedia learning. A thorough and final review was given by the preschool director to ensure the most important components of the workplace were included and that the questions asked were aligned with those components.

A fifth limitation was the method of measuring comprehension. For the multiple-choice questions, participants had a choice between four various answers, each with a picture associated with the main idea of the answer choice. Participants had a 25% chance of answering correctly, which may also be a factor in the variability of baseline results. Because each answer had a picture associated with it, participants may have memorized the correct picture per question over the course of the study. To counter for this, the order of question pages and answers were varied each day. Another method of comprehension assessment option that would alleviate these issues would be to have the participant state their own answer to the question. The issue with this method was that the participant is dependent upon another person for evaluation of a correct response and one of the intentions of this intervention design was to encourage independence in this process. This was also why the study included the performance task as a measure of comprehension. Although the results of the performance task were not significant, this information was important to the development of future research.

A sixth limitation was that the research was also the instructor, which may introduce bias to the study. To counter for this, a second instructor was trained in the implementation procedures and ran 22% of the overall sessions. Differences in scores were examined between the two researchers and no patterns emerged.
A final limitation was the variety of problems that arose surrounding the use of technology. When VoiceOver was turned on, navigation of the iBook™ page became extremely challenging. The participants had to learn a whole new set of rules for navigating from page to page (three-finger swipe instead of one), turning on the read aloud (tap the top of the screen and then swipe down with two fingers), and selecting an answer within the quiz widget (instead of one touch on the selection, participants had to tap once to select the item and then double-tap the item to officially select it). This challenge led to the creation of an additional graphic organizer for the participants to use to support their navigation of the text. Because of the fine motor skills needed to navigate the VoiceOver mode, Kate’s intervention had to be adapted. She was not able to double-tap quickly enough to select a response in the quiz widget. She became increasingly frustrated with this so the team made an adjustment. She was taught to use the Assistive Touch tool, which included a screen reader component. When the screen reader is activated, it reads the whole page, goes to the next and allows the listener to make a selection without the “double-tap” needed in VoiceOver mode. There were additional issues that surrounded the use of the VoiceOver. The text on the screen did not always activate as planned and widget text had to be typed into the additional tools for the page. Future research should consider the issues that surround the use of these technology components and perhaps use different applications or software programs.

Recommendations for Future Research

The study results suggest that teachers were able to implement this multimedia strategy with high fidelity and that young adults with moderate ID were able to take a leadership role in the process early on. The participants acquired text comprehension skills using a graphic organizer, a prompting hierarchy, and repeated reading strategy by correctly answering multiple-
choice questions and some types of performance tasks. This intervention should be replicated by at least two more researchers in two more locations to support the findings and strengthen external validity (Gast & Ledford, 2014). Replications should also be done with additional students in this age group including a wider variety of texts. Text examples for future research in the use of this multicomponent treatment package could include college course texts, college honor code texts, and other employment-based texts such as memos and emails. Research into the design and implementation of a UDL-designed employee training program based on multimedia learning principles for workplaces should also be explored.

The results of the performance task indicated several areas of future research. First, students with moderate to significant ID should be taught as early as possible to use comprehension strategies for real-world and workplace-based texts. If children receive access and training on this process early on, their potential for understanding and generalization of this type of information by the time they are of employment age is greatly increased.

Second, future research should include a video modeling component embedded within the text of the handbook. Video prompting and modelling has been used frequently with this population to successfully teach a set of tasks. For example, Burckley et al. (2015) used video prompts and visual cues to teach an 18-year-old with autism and ID to complete a set of steps in a shopping task analysis. Cannella-Malone et al. (2013) also used video prompting on an iPod Touch® to teach table washing and vacuuming skills to young adults with moderate to significant ID. Adding the video modeling component to the handbook has a great potential for teaching the skills steps that did not generalize for the participants of this study through the read aloud alone.

Another option would be to incorporate the least-to-most prompting hierarchy to the performance task as it was for the multiple-choice questions. Systematic instruction that includes
a prompting hierarchy is an evidence-based practice for teaching a set of skills in a task analysis to individuals with significant disabilities (Browder et al., 2008; Cooper, Heron, & Heward, 2007; Spooner et al., 2015). Future research should include incorporating this step into the performance task component to improve outcomes.

Finally, there were many challenges in working with the iBooks™ platform, especially when engaging the VoiceOver tool. There were limitations on formatting the iBook™ and the quiz widgets and the team encountered several instances of technology glitches that would suddenly exit the participant out of the program. Other platforms that may be easier to use for adapted books should be explored.

**Implications for Practice**

The findings of this study reveal several implications for practitioners working with postsecondary young adults with ID, either in postsecondary education or employment settings. The baseline data for most of the participants indicated young adults with ID that participated in a postsecondary education program were not able to consistently answer comprehension questions based on the adapted text alone. This suggests that they need further supports, such as systematic instruction, repeated readings, and graphic organizers to truly make improvement in their comprehension of the text. Further, these strategies should be taught to students with moderate to significant ID at an earlier age, so they develop these foundational skills before reaching young adulthood.

The data also supports the adaptation of the text and self-check embedded into the handbook. The participants of this study, picked up on how to check their answers in the text very quickly. This is promising for independent access to the employee handbook for this population. This would be more important for employers and job developers than teachers;
however, teachers could work on the systematic instruction component to teach the repeated reading strategy before students are in the workplace setting. This will provide them with the skills to generalize to new texts and, therefore, they will be better prepared for competitive integrated employment settings.

The researcher-developed questions were primarily based on factual recall, but were aligned with key components that the employer felt was essential to the duties interns have at the preschool. The comprehension data and the social validity data support the use of these types of questions. Those who work with employers and young adults with moderate ID should apply this specific measure of individualized adaptation to similar employment-based texts to improve comprehension.

This intervention was designed to promote independent access to the text by teaching the participants to open and use the VoiceOver tool. Now that they know how to use this text-to-speech tool, it should be easy to generalize this skill to other texts on Apple® devices. The participants were also successfully taught how to check their responses to the questions by going back into the text and listening again. Practitioners should employ this skill-building strategy to teach young adults with moderate ID how to access similar text independently to build their understanding of a text.

Finally, continued data collection on the use of similar multicomponent literacy treatment packages is important because evidence on the use of this type of intervention for young adults with ID is still emerging. Practitioners should use best practices during instruction to gauge the effectiveness of any intervention. This includes continued progress monitoring and adapting interventions as needed. This population is highly variable in skill set and limitations, so individualization is important for success.
Conclusion

Current research that supports the text comprehension skills of postsecondary students with ID is minimal. Because postschool outcomes are so poor for this population and literacy skills are limited, it is essential to continue to explore how best to provide the supports, strategies, and access to important texts for young adults with ID so transition programs and employers can include these practices within their preemployment and ongoing employment training. The purpose of this study was to examine the effects of a multimedia shared story (adapted employee handbook) using speech-to-text technology on the text comprehension skills of college students with moderate ID.
## APPENDIX A: LITERATURE SUMMARY TABLES

### Summary of Technology Literature

<table>
<thead>
<tr>
<th>Study / design</th>
<th>Independent variables</th>
<th>Dependent variables</th>
<th>Participants</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burckley, Tincani, &amp; Fisher (2015)</td>
<td>Use of iPad® and Book Creator software to provide visual cues and video prompts during the shopping.</td>
<td>Percentage of steps completed independently on a shopping task analysis.</td>
<td>One 18-year-old female with autism and ID.</td>
<td>Participant increased from 17 to 22% steps at baseline to 62 to 66% at the end of intervention. Participant completed 88% in maintenance and generalization. All social validity respondents strongly agreed that study goals were important, iPad® format was effective and easy to use, and were somewhat likely to use it to teach other skills.</td>
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<tr>
<td>Cannella-Malone, Brooks, &amp; Tullis (2013)</td>
<td>Video prompts displayed on an iPod Touch® to teach washing a table and vacuuming</td>
<td>Number of steps completed correctly in each task analysis. Step had to be completed correctly within 30s without prompting to be correct. Steps to the use of the video prompting on the iPod were also recorded.</td>
<td>Four high school students, ages 15 to 17, with moderate to profound IDD and physical disabilities.</td>
<td>Participants improved in their number of steps from baseline to intervention in a range from 7%-57% at baseline to 83%-100% at intervention. Only 2 students showed significant progress in all areas of the study. One never made it past the first stage.</td>
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<tr>
<td>Cannella-Malone, Wheaton, Wu, Tullis, &amp; Park (2012)</td>
<td>Video prompting with error correction and video prompting without error</td>
<td>* Percentage of correctly completed steps in each task. * Percentage of steps that required error correction.</td>
<td>Three 15-year-old students with moderate to profound ID.</td>
<td>All 3 participants improved over baseline levels in both interventions. Only 2 met the mastery criterion for table washing. Acquisition of</td>
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<tr>
<td>Study</td>
<td>Design</td>
<td>Intervention</td>
<td>Outcomes</td>
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<tr>
<td>Cihak, McMahon, Smith, Wright, &amp; Gibbons (2015)</td>
<td>Multiple probe across devices design.</td>
<td>Peer tutor and task analysis instruction using total-task chaining using a desktop computer, laptop computer, and then an iPad®</td>
<td>* Number of sessions needed to achieve mastery criterion.</td>
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<td>Number of correctly performed task-analyzed steps for accessing the email account, responding to an email, and writing a new email to a peer tutor. There were 21 steps total.</td>
<td>Four college students, ages 21 to 23 with ID, attending a post-secondary education program.</td>
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<tr>
<td>Creech-Galloway, Collins, Knight, &amp; Bausch (2013)</td>
<td>Multiple probe across participants design.</td>
<td>Treatment package that included 6 videos of real-world applications of the Pythagorean theorem played on an iPad®, simultaneous prompting procedure, and calculator.</td>
<td>Number of correct responses to a Pythagorean theorem task analysis during daily probe trials.</td>
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<td>* Intervention: Video modeling viewed on an iPad® of correct responses during</td>
<td>Four high school students, ages 15 to 17, with moderate to severe ID.</td>
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<tr>
<td>Hart &amp; Whalon (2012)</td>
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<td>* Intervention: Video modeling viewed on an iPad® of correct responses during</td>
<td>Number of unprompted correct responses during science during a 25</td>
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<td>One 16-year-old young man with autism and</td>
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<td>The results were variable, but overall, he demonstrated higher levels of correct responses in the</td>
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<tr>
<td>Study</td>
<td>Design</td>
<td>Intervention Details</td>
<td>Participants</td>
<td>Results</td>
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<tr>
<td>Single-subject, ABAB reversal design.</td>
<td>Science were shown 3 times before observation period. *Withdrawal: business as usual, no video.</td>
<td>Moderate ID.</td>
<td>Intervention phases when compared to baseline (4-6% to 24-42%). He did need continued prompting to answer correctly.</td>
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<tr>
<td>Kelley, Test, &amp; Cooke (2013)</td>
<td>*Pedestrian navigation training using picture prompts on a video played on an iPod</td>
<td>4 adults, ages 18 to 26, with IDD, attending a PSE.</td>
<td>100% PND, baseline mean ranges were 3.4% to 4.3% to intervention between 88.2% to 92.1%. All independently navigated to the locations by the end of intervention and while in maintenance with 100% accuracy.</td>
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<tr>
<td>Multiple probe across participants design.</td>
<td>*Pedestrian navigation skills to and from a variety of locations *Percentage correctly reached landmarks</td>
<td>Two adults, ages 18 and 19, with autism and IDD.</td>
<td>Both participants immediately increased their levels of each dependent variable immediately after intervention. One steadily improved, the other levelled off and was then given the self-directed prompting intervention and made further progress.</td>
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<tr>
<td>Payne, Cannella-Malone, Tullis, &amp; Sabielny (2012)</td>
<td>*Video prompting of steps to a recipe displayed on an iPod Touch® with error correction. *Video prompting with In vivo Training. *Teaching students to use the iPod Touch® independently through most-to-least prompting.</td>
<td>One 17-year-old with moderate ID.</td>
<td>Participant increased correct task steps from a baseline range across tasks of 12% to 20% up to 78% to 84% in the first session of intervention. Percentage of prompts in all areas steadily</td>
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<tr>
<td>Multiple probe across participants with AB design for one student.</td>
<td>*Percentage of correctly completed steps in two recipe tasks analyses. *Percentage of correctly completed steps in the use of the iPod Touch® during self-directed video prompting.</td>
<td>Two young adults, ages 18 and 19, with autism and IDD.</td>
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<tr>
<td>Study</td>
<td>Design</td>
<td>Intervention Details</td>
<td>Outcome</td>
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<td>Uphold, Horner, &amp; Loseke (2016)</td>
<td>Single-subject, A-B-A-B withdrawal design.</td>
<td>*Video to review (video feedback). *Percentage of prompts for error correction, video and controlling prompt. *Percentage of prompts needed to use technology.</td>
<td>Participants improved in level by 15 to 60 points with 87.5% to 100% PND. They learned to program the devices within 4 to 6 sessions.</td>
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<tr>
<td>Weng &amp; Bouck (2014)</td>
<td>Multiple probe across participants design.</td>
<td>Constant time delay used to teach the programming and use of an iPod Touch® to view photos of exercises. *Percentage of independently completed exercises using photos. * Percentage of independently completed steps in programming the iPod® with the exercises (only in intervention and generalization).</td>
<td>Three middle and high school students, ages 15 to 17, with autism and ID. Mixed results. The intervention was not effective for one student, even with prompting hierarchy. The other two students demonstrated effectiveness in their selections and task performance; however, one needed additional prompting.</td>
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<tr>
<td>Wu, Cannella-Malone, Wheaton, &amp; Tullis (2016)</td>
<td>*Video prompting with error correction (least to most prompting) of the two tasks</td>
<td>*Video prompting with error correction (least to most prompting) of the two tasks</td>
<td>Two high school students, ages 14 and 17, with moderate Both eventually reached mastery in the skills. Overall the fading during intervention procedure (which chunked the</td>
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</table>
Multiple probe across participants design.

*Number of sessions needed to meet criterion.

*Two fading procedures: one during intervention and one following mastery of the skill.

*inPromptu (a video prompting app) and First Then Visual Schedule (picture schedule app) apps displayed on an iPod Touch®.

*Least-to-most prompting hierarchy to teach navigation.

*Multiple exemplar training was used for those who did not reach mastery in the initial intervention.

*Percentage of correct independent navigation steps within and between the two apps.

*Percentage of correct responses to fixed, varied, and novel schedules for activities of daily living.

*Percentage of correct video self-prompting responses.

Wu, Wheaton, & Cannella-Malone (2016)

- *Two fading procedures: one during intervention and one following mastery of the skill.*
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- *Percentage of correct independent navigation steps within and between the two apps.*
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- *Percentage of correct video self-prompting responses.*

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- *Percentage of correct responses to fixed, varied, and novel schedules for activities of daily living.*
- *Percentage of correct video self-prompting responses.*

Note. ID = Intellectual disability. IDD = Intellectual and/or developmental disabilities. PSE = Postsecondary education program.

Summary of Postsecondary Interventions Literature

<table>
<thead>
<tr>
<th>Study/design</th>
<th>Independent variables</th>
<th>Dependent variables</th>
<th>Participants</th>
<th>Results/conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chezan, Drasgow, &amp; Marshall (2012)</td>
<td>General-case programming, which includes instruction</td>
<td>* Locating information on syllabi within 12s of initial request (verbal response)</td>
<td>Single participant, Tom, 21, diagnosed with PDD- PDD</td>
<td>Tom achieved a significant increase between baseline (which was at floor = 0) in all three to</td>
</tr>
<tr>
<td>Study Details</td>
<td>Experimental Design</td>
<td>Materials and Methods</td>
<td>Participants</td>
<td>Findings</td>
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| Evmenova & Behrmann (2014) | Video adaptations, including alternative narration, 2 types of captions (highlighted text and picture/word based), and interactive video – same as above | * Number of correct factual questions answered.  
* Number of correct inferential questions answered. | 6 post-secondary students, ages 19 to 22, with ID | Students improved significantly with adapted and interactive video. No difference was found between types of captions. Students enjoyed the adapted and interactive videos per social validity interviews. |
| Evmenova, Behrmann, Mastropieri, Baker, & Graff (2011) | Treatment package: alternative narration, highlighted text, picture/word-based captions, interactive video searching in nonfiction | Number of correct oral responses measuring comprehension of videos | 5 students with ID/DD, ages 19 to 24, participating in a college program. | Both types of adapted videos equally improved comprehension scores from baseline. No one treatment package was statistically better than the other. Where they really saw improvement was with the use of the interactive search option. Students went back into parts of the
academic video clips. video that held answers to the questions and review. They were prompted to do this with incorrect responses.

<table>
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<tr>
<th>Gilson &amp; Carrter (2016)</th>
<th>Multiple probe across participants</th>
<th>* Percentage of time on task engagement. * Number of social and task interactions in 30s intervals. * Time in proximity to another person in the job setting. * Number of times each type of coaching was given.</th>
<th>3 college students, ages 20 to 22, with ASD or ID.</th>
<th>Social interactions increased. Task engagement was maintained even when job coach proximity was reduced and prompts were delivered via bug-in-ear devices. Social validity was addressed by participants – considered beneficial.</th>
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<tbody>
<tr>
<td>A job coaching package that included reduced proximity of job coach to student, use of covert audio coaching (technology), social-focused coaching, task-related proximal coaching.</td>
<td>* Percentage of time on task engagement. * Number of social and task interactions in 30s intervals. * Time in proximity to another person in the job setting. * Number of times each type of coaching was given.</td>
<td>3 college students, ages 20 to 22, with ASD or ID.</td>
<td>Social interactions increased. Task engagement was maintained even when job coach proximity was reduced and prompts were delivered via bug-in-ear devices. Social validity was addressed by participants – considered beneficial.</td>
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<tr>
<td>Green, Hughes, &amp; Ryan (2011)</td>
<td>Vibrating watch that would activate when it was time to finish work and return to her class across campus. Included a visual prompt on the watch to go to class.</td>
<td>Time it took (latency) for participant to return to her class after work was over.</td>
<td>1 young adult, age 22, female with ID, enrolled in a college program.</td>
<td>Participant demonstrated a significant reduction in the amount of time she was late to class in both intervention phases, compared to baseline (approx. 15-minute difference), with effect sizes calculated at 1.0.</td>
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<tr>
<td>ABAB withdrawal design</td>
<td>RAAC – Reread-Adapt and Answer-Comprehend intervention</td>
<td>* Number of correct words per minute (fluency). * Number of correctly answered</td>
<td>Three young adults, age 21, with autism and mild to</td>
<td>Number of correct words per minute increased for all. Number of errors per passage were greatly</td>
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</table>

<p>| Hua, Hendrickson, Therrien, Woods-Groves, | RAAC – Reread-Adapt and Answer-Comprehend intervention | * Number of correct words per minute (fluency). * Number of correctly answered | Three young adults, age 21, with autism and mild to | Number of correct words per minute increased for all. Number of errors per passage were greatly |</p>
<table>
<thead>
<tr>
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<th>Measures</th>
<th>Participants</th>
<th>Findings</th>
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<td>Ries, &amp; Shaw (2012)</td>
<td>Multiple baseline across participants</td>
<td>Comprehension questions</td>
<td>Moderate ID, enrolled in a college program</td>
<td>Reduced in intervention for all participants. Number of comprehension questions answered correctly did slightly increase.</td>
</tr>
<tr>
<td>Hua, Morgan, Kaldenberg, &amp; Goo (2012)</td>
<td>Group design (pre-post test)</td>
<td>*Number of correct answers to target items calculations. *Number of errors in procedure.</td>
<td>10 post-secondary students, ages 18 to 24, with disabilities including LD, ASD, ID.</td>
<td>The treatment group outperformed the comparison group. They were also able to generalize the procedure to tasks that required percent values knowledge.</td>
</tr>
<tr>
<td>Hua, Woods-Groves, Kaldenberg, Lucas, &amp; Therrien (2015)</td>
<td>Group design</td>
<td>*Number of questions answered correctly on a pre-test / post-test worksheet about calculating tip and total bill. *Collected one functional performance assessment of participants calculating tip and total bill in a real-life setting. Credit was given for accurate tip and bill calculations.</td>
<td>14 young adults, ages 19 to 22, with ID enrolled in a college program.</td>
<td>Treatment group outperformed control in calculating tip and bill amounts and transferring the strategy to solve different problems in the same schema. 5 students generalized the strategy to a real-life situation.</td>
</tr>
<tr>
<td>Hua, Woods-Groves, Kaldenberg, &amp; Scheidecker (2013)</td>
<td>Constant time delay (to teach unknown vocab embedded in expository texts).</td>
<td>Vocabulary acquisition and retention, expository reading comprehension based on number of correct responses to comprehension and vocabulary</td>
<td>4 young adults, ages 19 to 21, with ID in a postsecondary education program.</td>
<td>Vocabulary knowledge acquisition was greater during treatment than control. Comprehension results were not clear.</td>
</tr>
<tr>
<td>Alternating treatments design</td>
<td>Kelley, Rivera, &amp; Kellems (2016)</td>
<td>Direct systematic instruction (Model-Lead-Test)</td>
<td>Number of correct steps used in operation of Google Glass.</td>
<td>Three young adults, ages 19 to 20, with mild to moderate ID, enrolled in a college program.</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------------------------</td>
<td>-----------------------------------------------</td>
<td>----------------------------------------------------------</td>
<td>-----------------------------------------------------------------</td>
</tr>
<tr>
<td>Multiple probe across participants</td>
<td>Kelley, Test, &amp; Cooke (2013)</td>
<td>Pedestrian navigation training using picture prompts on a video played on an iPod®.</td>
<td>*Number of correct and independent travels to a specified route. *Percentage of pictured landmarks reached correctly for each route.</td>
<td>Four young adults, ages 18 to 26, with ID/DD, attending a college program.</td>
</tr>
<tr>
<td>Multiple probe across participants</td>
<td>Mazzotti, Kelley, &amp; Coco (2015)</td>
<td>Teaching students to develop and use a Summary of Performance to teach self-advocacy skills</td>
<td>Advocating for accommodations and supports during PCP meetings and employment settings.</td>
<td>Three young adults, ages 18 to 27, with ID, participating in a college program.</td>
</tr>
<tr>
<td>Multiple probe across participants</td>
<td>McMahon, Cihak, &amp; Wright (2015)</td>
<td>Location-based augmented reality navigation compared to Google Maps</td>
<td>Ability to independently make navigation decisions when travelling to unknown business locations in a city.</td>
<td>3 college students with ID, 1 college student with ASD</td>
</tr>
<tr>
<td>Treatment Design and Paper Maps</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>McMahon, Cihak, Wright, &amp; Bell (2016)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiple probe across behaviors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Augmented reality application to teach science vocabulary. Use of Universal Design principles in the technology.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of correct responses to questions for defining and labelling science vocabulary.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Four young adults, ages 19 to 25, with ASD and ID.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PND for participants was 85%, 89%, 79-94%, and 92.9-100% for each participant, demonstrating a very effective intervention.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Wang, Eberhard, Voron, & Bernas (2016)

<table>
<thead>
<tr>
<th>Group design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Email modeling and scaffolding with mature models (teacher candidates).</td>
</tr>
<tr>
<td>Social writing quality based on a rubric of writing mechanics, lexical production, syntactical length and complexity, writing cohesion, use of figurative language, pragmatic propriety, and writing motivation.</td>
</tr>
<tr>
<td>10 college students, ages 18 to 20, with ASD and ID, 10 teacher candidates in university program</td>
</tr>
<tr>
<td>Various degrees of improvement in writing mechanics, lexical and syntactic complexity, writing cohesion, pragmatic propriety and writing motivation. Figurative language was not affected.</td>
</tr>
</tbody>
</table>

*Note.* ASD = autism spectrum disorder; DD = developmental disabilities; ID = intellectual disability; LD = learning disabilities.
APPENDIX B: STUDENT RECRUITMENT SCRIPT

Please read the following information to potential participants.

Hello, our names are Josh Baker and Stephanie Devine and we are researching the helpfulness of something called “systematic instruction” in teaching young adults with intellectual disabilities to better understand the text in adapted employee handbook. Systematic instruction includes elements like a graphic organizer, reminders from the instructor on certain steps to follow when reading and answering questions about a text, and breaking down a task into a series of steps. You have been invited to be a part of this study because you are enrolled in UNLV’s Project FOCUS program and you have shown an interest in working at the university preschool.

Part of the study will be teaching you how to access an adapted employee handbook for the university preschool on an iPad. The handbook will have pictures and questions about the text included. You will be asked to listen to the handbook using headphones. After the reading is finished, you will be asked to perform a task similar to what you just read about. The study will take place during one of your breaks between classes on the UNLV campus. Each session should take about 30 minutes of your time, 4 to 5 days per week, depending on how often you are on campus and are available to meet with us.

Before you can be a part of this study, you will need to read through and sign the Informed Consent Form. Just so you know, this study is totally voluntary. You do not have to participate if you don’t want to. Nothing bad will happen to your class grades or your participation in Project FOCUS if you choose not to be a part of this study. You will not have any changes to your current schedule.
If you have any questions about the study, our phone numbers, as well as the contact information for the Office of Research Integrity, are listed on your consent form.

Thank you so much for listening and we hope you have a wonderful day!
TITLE OF STUDY: Effects of Systematic Instruction on College Students’ Comprehension of Adapted Employee Handbooks

INVESTIGATOR(S) AND CONTACT PHONE NUMBER: Dr. Josh Baker, 702-895-3238; Stephanie Devine, 702-321-3128

The purpose of this study is to look at how systematic instruction helps you strengthen your understanding of an adapted employee handbook. You are being asked to participate in the study because you meet the following criteria: (a) you are a student in the Project FOCUS program, (b) you are qualified for services under the category of intellectual disability, (c) you are interested in working at the university preschool, (d) you read between first and third grade level, and (e) you are interested in participating in this study.

If you volunteer to participate in this study, you will be asked to do the following: Read/listen to sections of an adapted employee handbook and answer questions about the text. You will also be asked to perform work-based tasks related to the portion of the handbook that you read/listened to.

This study includes only minimal risks. The study will take 30 minutes per weekday for 4 to 5 weeks of your time. You will not be compensated for your time.

For questions regarding the rights of research subjects, any complaints or comments regarding the manner in which the study is being conducted you may contact the UNLV Office of Research Integrity – Human Subjects at 702-895-2794, toll free at 877-895-2794, or via email at IRB@unlv.edu.

Your participation in this study is voluntary. You may withdraw at any time. You are encouraged to ask questions about this study at the beginning or any time during the research study.

Participant Consent:
I have read the above information and agree to participate in this study. I am at least 18 years of age. A copy of this form has been given to me.

APPENDIX D: PROCEDURAL FIDELITY CHECKLISTS

For Baseline

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hand participant unlocked iPad and say, “Open the Preschool Employee Handbook. I will read each page to you and then read a multiple-choice question out loud. Answer each question the best you can and then go to the next page. Follow these steps until you reach the end of the book.”</td>
</tr>
<tr>
<td>2</td>
<td>Instructor waits 10s, if no or incorrect response, instructor will complete the steps needed to open the correct book.</td>
</tr>
<tr>
<td>3</td>
<td>If participant asks a question about the procedure, the research will respond with “Just do your best.”</td>
</tr>
<tr>
<td>4</td>
<td>At the end of each page, the instructor will verbally prompt the student to swipe to the next page.</td>
</tr>
<tr>
<td>5</td>
<td>At the comprehension questions, the participant will be given 10 seconds to answer by touching the corresponding circle. After 10 seconds of no response, instructor will verbally prompt participant. If no response after 5s, instructor will verbally prompt one more time. If still no response, instructor will swipe to the next page of text and begin reading.</td>
</tr>
<tr>
<td>6</td>
<td>Repeat this process for each page of text. At the performance task, wait 10 seconds for participant to begin the task. If no response after 10 seconds, verbally prompt participant to begin. At each pause of 10 seconds, verbally prompt with “Are you finished?”</td>
</tr>
<tr>
<td>7</td>
<td>If participant doesn't respond after another 10s, end the session.</td>
</tr>
<tr>
<td>8</td>
<td>Thank and verbally praise the participant for a job well done at the end of each session.</td>
</tr>
</tbody>
</table>

For Intervention

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Instructor reviews graphic organizer and how to use with the participant.</td>
</tr>
<tr>
<td>2</td>
<td>Hand participant iPad® and ask to open the appropriate iBook® text.</td>
</tr>
<tr>
<td>3</td>
<td>Instructor waits 5s, if no response or incorrect book is opened, instructor will deliver verbal prompt (first incorrect).</td>
</tr>
<tr>
<td>4</td>
<td>Instructor waits 5s, if still no response or incorrect book is opened, instructor will deliver model prompt (second incorrect).</td>
</tr>
<tr>
<td>5</td>
<td>Instructor waits 5s, if still no response or incorrect book is opened, instructor will deliver physical prompt (third incorrect).</td>
</tr>
<tr>
<td>6</td>
<td>Participant should begin the text to speech for the text, if correct, instructor does nothing.</td>
</tr>
<tr>
<td>7</td>
<td>If no response, or incorrect response after 5s, instructor will deliver least-to-most prompts as in steps 3-5, first incorrect - verbal prompt</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>(a) second incorrect - model prompt</strong></td>
<td>(b) third incorrect - physical prompt</td>
</tr>
<tr>
<td>Participant should follow/listen to the text-to-speech for the handbook. If correct, instructor does nothing. If incorrect, follow prompting hierarchy (steps 3-5).</td>
<td></td>
</tr>
<tr>
<td><strong>(a) first incorrect - verbal prompt</strong></td>
<td>(b) second incorrect - model prompt</td>
</tr>
<tr>
<td>(c) third incorrect - physical prompt</td>
<td></td>
</tr>
<tr>
<td><strong>Error Correction Procedure:</strong> After comprehension question and answers are read, participant should select the answer. If participant responds incorrectly or doesn't respond after 5s, begin least-to-most prompting (&quot;No, that isn't correct.&quot; Draw their attention to the graphic organizer and read out the type of question and answer the participant should be looking for. &quot;Remember, <strong>What</strong> questions are looking for a Thing. Let's go back and listen again.&quot; Then prompt participant to listen to the previous page again.).</td>
<td></td>
</tr>
<tr>
<td>Second incorrect or doesn't respond after 5s, use script above, then return to previous page and play the text of the <strong>appropriate section</strong> again.</td>
<td></td>
</tr>
<tr>
<td>Paragraph with answer was re-read and the question repeated.</td>
<td></td>
</tr>
<tr>
<td>Third incorrect or doesn't respond after 5s, instructor will point to and read aloud the correct text/sentence on the previous page and model the correct response. (&quot;The answer is _______. Your turn. You point to ______.&quot;)</td>
<td></td>
</tr>
<tr>
<td>Incorrect response on fourth attempt, interventionist gives hand-over-hand assistance.</td>
<td></td>
</tr>
<tr>
<td>Participant is given verbal praise and the correct answer is restated.</td>
<td></td>
</tr>
<tr>
<td>If/when correct response is given, wait 5 seconds, no response or incorrect response given, then interventionist verbally prompts student on to the next page.</td>
<td></td>
</tr>
<tr>
<td>Repeat error correction procedure for each comprehension question.</td>
<td></td>
</tr>
<tr>
<td>When reading is completed, interventionist gives verbal praise.</td>
<td></td>
</tr>
<tr>
<td>When handbook section and questions are completed, interventionist will ask student to perform a task related to the text. Interventionist will say, “Now, remember, you can look back in the text if you need help with the performance task.”</td>
<td></td>
</tr>
<tr>
<td>Wait 10 seconds, if no response, restate performance task request.</td>
<td></td>
</tr>
<tr>
<td>Wait 10 seconds, if still no response, end session.</td>
<td></td>
</tr>
<tr>
<td>Record correct performance of task with a + or incorrect with a -.</td>
<td></td>
</tr>
<tr>
<td>At end of session, give verbal praise for participation.</td>
<td></td>
</tr>
</tbody>
</table>

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For Maintenance

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Instructor reviews graphic organizer and how to use.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Hand participant iPad® and ask to open the appropriate iBook® text.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Instructor waits 5s, if no response or incorrect book is opened, instructor will deliver verbal prompt (first incorrect).</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Instructor waits 5s, if still no response or incorrect book is opened, instructor will deliver model prompt (second incorrect).</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Instructor waits 5s, if still no response or incorrect book is opened, instructor will deliver physical prompt (third incorrect).</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Participant should begin the text to speech for the text, if correct, instructor does nothing.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>If no response, or incorrect response after 5s, instructor will deliver least-to-most prompts as in steps 3-5. first incorrect - verbal prompt (a) second incorrect - model prompt (b) third incorrect - physical prompt</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Participant should follow/listen to the text-to-speech for the handbook and answer the questions.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>No prompting for errors. Instead, give a verbal prompt for participant to move on to the next section after 5 seconds of no response.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>When reading is completed, interventionist gives verbal praise.</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>When handbook section and questions are completed, interventionist will ask student to perform a task related to the text.</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Wait 10 seconds, if no response, restate performance task request.</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Wait 10 seconds, if still no response, end session.</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Record correct performance of task with a + or incorrect with a -.</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>At end of session, give verbal praise for participation.</td>
<td></td>
</tr>
</tbody>
</table>
## APPENDIX E: DATA COLLECTION INSTRUMENT

<table>
<thead>
<tr>
<th>Comprehension Questions</th>
<th>Number of Unprompted Correct Responses to Comprehension Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
</tr>
<tr>
<td><strong>Student A</strong></td>
<td></td>
</tr>
<tr>
<td>Section 1</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Question 1</td>
<td></td>
</tr>
<tr>
<td>Question 2</td>
<td></td>
</tr>
<tr>
<td>Question 3</td>
<td></td>
</tr>
<tr>
<td>Question 4</td>
<td></td>
</tr>
<tr>
<td>Question 5</td>
<td></td>
</tr>
<tr>
<td>Performance Task</td>
<td></td>
</tr>
</tbody>
</table>

| **Student B**           |          |              |             |
| Section 2               | 1 2 3 4 5| 6 7 8 9 10  | 11 12 13 14 15 |
| Question 1              |          |              |             |
| Question 2              |          |              |             |
| Question 3              |          |              |             |
| Question 4              |          |              |             |
| Question 5              |          |              |             |
| Performance Task        |          |              |             |

| **Student C**           |          |              |             |
| Section 3               | 1 2 3 4 5| 6 7 8 9 10  | 11 12 13 14 15 |
| Question 1              |          |              |             |
| Question 2              |          |              |             |
| Question 3              |          |              |             |
| Question 4              |          |              |             |
| Question 5              |          |              |             |
| Performance Task        |          |              |             |

| **Student D**           |          |              |             |
| Section 3               | 1 2 3 4 5| 6 7 8 9 10  | 11 12 13 14 15 |
| Question 1              |          |              |             |
| Question 2              |          |              |             |
| Question 3              |          |              |             |
| Question 4              |          |              |             |
| Question 5              |          |              |             |
| Performance Task        |          |              |             |

Note: + = correct response, - = incorrect response, V = verbal prompt, M = model prompt, P = physical prompt.
Emergency Procedures - Injury

* Emergency phone numbers are by phones.
* First Aid Kits are above children’s sink in each class.
* Ice packs are in the freezer. Always cover with a cloth or sock. Because then the ice won’t hurt or burn the children. Put ice pack on and off every minute.
* Head staff will bring child to office infirmary.

Cuts and Scrapes

* Put on rubber gloves
* If cut is large, report to office infirmary.
* Wash cut with warm water and soap.
* Dry well.
* Put on band aid.
* Throw away gloves in plastic bag.
* Tie bag. Put bag in plastic lined trash can.
* Write an ouch report and give to head staff

Review Question

Explain why you cover the ice pack with a sock or cloth before you use it.

A. So the ice pack stays clean.
B. So you keep your hands warm.
C. So you can write an Ouch report.
D. So the ice won’t hurt/burn the children’s skin.

Choose an answer to the question.
APPENDIX G: SOCIAL VALIDITY SURVEYS

Program Director Social Validity Survey

Please select the response that best suits your opinion on the question.

1. The intervention was easy to follow and was appropriate for teaching the desired skill.

2. The text used was appropriate for the students.

3. My students gained important skills from this intervention.

4. This intervention was not too time-intensive or expensive to implement.

5. I would recommend this intervention to others.

6. Do you have any additional comments or concerns regarding the intervention?

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

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Preschool Director Social Validity Survey

Please select the response that best suits your opinion on the question.

1. The intervention was easy to follow and was appropriate for teaching the desired skill.

   □ Strongly Agree  □ Agree  □ Somewhat Agree  □ Neither Agree nor Disagree  □ Somewhat Disagree  □ Disagree  □ Strongly Disagree

2. The text used was appropriate for the students.

   □ Strongly Agree  □ Agree  □ Somewhat Agree  □ Neither Agree nor Disagree  □ Somewhat Disagree  □ Disagree  □ Strongly Disagree

3. My future employees gained important skills from this intervention.

   □ Strongly Agree  □ Agree  □ Somewhat Agree  □ Neither Agree nor Disagree  □ Somewhat Disagree  □ Disagree  □ Strongly Disagree

4. This intervention was not too time-intensive or expensive to implement.

   □ Strongly Agree  □ Agree  □ Somewhat Agree  □ Neither Agree nor Disagree  □ Somewhat Disagree  □ Disagree  □ Strongly Disagree

5. I would recommend this intervention to others.

   □ Strongly Agree  □ Agree  □ Somewhat Agree  □ Neither Agree nor Disagree  □ Somewhat Disagree  □ Disagree  □ Strongly Disagree

6. Do you have any additional comments or concerns regarding the intervention?

   _______________________________________________________________
   _______________________________________________________________
   _______________________________________________________________
   _______________________________________________________________
Student Participant Survey

Please circle the answer you like the best.

1. I learned to use the graphic organizer to answer questions about what we read.
   
   I liked this.  
   I’m not sure.  
   I didn’t like this.

2. I learned to use the text-to-speech tool on the iPad.

   I liked this.  
   I’m not sure.  
   I didn’t like this.

3. I worked one-on-one with a teacher for this project.

   I liked this.  
   I’m not sure.  
   I didn’t like this.

4. The teacher asked me questions when I wasn’t sure about an answer.

   I liked this.  
   I’m not sure.  
   I didn’t like this.

5. We used picture charts to answer questions.

   I liked this.  
   I’m not sure.  
   I didn’t like this.
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and graphic organizers to teach science concepts to students with autism spectrum
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CURRICULUM VITAE

STEPHANIE M. DEVINE
Rodman Scholar Graduate Assistant
Doctoral Candidate
Program: Special Education

Department of Educational and Clinical Studies
University of Nevada, Las Vegas
Email address: smdevine06@gmail.com

EDUCATION AND PROFESSIONAL CREDENTIALS

Degrees
Ph.D. 2018 University of Nevada, Las Vegas Special Education
M.Ed. 2009 University of Nevada, Las Vegas Special Education
B.A. 1998 California Lutheran University English

Licenses
State of Nevada Professional Educator’s License
Professional Special Education (Grades K-12), Intellectual Disabilities Endorsement

HONORS AND AWARDS

Spring 2017 Southwest Airlines Travel Award Recipient, University of Nevada, Las Vegas Foundation
Fall 2016 3rd Place Winner, University of Nevada, Las Vegas, 3-Minute Thesis “Grad Slam” Competition
2009 Certificate of Distinction, University of Nevada, Las Vegas, College of Education, Department of Educational and Clinical Studies Master’s Program
2010, 2011 RAVE Review Recipient, Clark County School District, Las Vegas, Nevada
2007-2009 Project Connect Grant Recipient, University of Nevada, Las Vegas, College of Education, Department of Educational and Clinical Studies

PROFESSIONAL EXPERIENCES

2017-2018 University of Nevada, Las Vegas, Department of Educational and Clinical Studies
Rodman Scholar Graduate Assistant (Currently teach a 2/2 and provide technical assistance to undergraduate and graduate scholars)
Doctoral Candidate (Dissertation proposed on June 25, 2017; IRB approved August 24, 2017; Defense expected for February 2018)

2015-2017  University of Nevada, Las Vegas, Department of Educational and Clinical Studies
             Visiting Lecturer (FTE=1.0 Taught a 4/4 coursework load)

2014-2015  University of Nevada, Las Vegas, Department of Educational and Clinical Studies
             Part-time Instructor (Taught a 1/1 coursework load)

2014  University of Nevada, Las Vegas, Department of Educational and Clinical Studies
             Guest Lecturer (Taught 1 session during Spring 2014)

2014-2015  Clark County School District, Las Vegas, NV
             Special Education Teacher, self-contained postsecondary program
             (POST – Postsecondary Opportunities for Students in Transition)
             Students with Autism and Intellectual Disability, Cheyenne High School

2012-2014  Clark County School District, Las Vegas, NV
             Special Education Instructional Facilitator, Cheyenne High School,
             Cahan Elementary School, and Parson Elementary School.
             Special Education Department Chair, Cheyenne High School

2008-2012  Clark County School District, Las Vegas, NV
             Special Education Teacher, self-contained class
             Students with Intellectual Disability and Autism, Cheyenne High School

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**TEACHING**

**University of Nevada, Las Vegas**

<table>
<thead>
<tr>
<th>Year</th>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring 2018</td>
<td>EDSP 487</td>
<td>Supervision of Student Teachers-Resource and Self-Contained</td>
</tr>
<tr>
<td>Spring 2018</td>
<td>EDSP 491</td>
<td>Supervision of Student Teachers-Resource and Self-Contained</td>
</tr>
<tr>
<td>Spring 2018</td>
<td>EDSP 414</td>
<td>Career Ed for Students with Disabilities (Undergraduate)</td>
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<tr>
<td>Spring 2018</td>
<td>ESP 718</td>
<td>Assessment of Persons with ID (Graduate, Modular)</td>
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<td>Fall 2017</td>
<td>ESP 737i</td>
<td>Supervision of Student Teachers-Resource</td>
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<td>Fall 2017</td>
<td>ESP 737c</td>
<td>Supervision of Student Teachers-Resource (Alternative Route to Licensure)</td>
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<td>Vocational and Career Education for Persons with Disabilities in Transition (Graduate)</td>
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<td>EDSP 432</td>
<td>Serving Individuals with Disabilities and Their Families (Online, Undergraduate)</td>
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<td>Summer 2017</td>
<td>ESP 755A</td>
<td>Medically Related Aspects of Disabilities (Online, Graduate)</td>
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<td>Career Ed for Students with Disabilities (Undergraduate)</td>
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<td>Spring 2017</td>
<td>ESP 718</td>
<td>Assessment of Persons with ID (Graduate, Modular)</td>
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<td>Spring 2017</td>
<td>ESP 701</td>
<td>Intro to Special Education (Online, Graduate)</td>
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<td>EDSP 432</td>
<td>Serving Individuals with Disabilities and Their Families (Online, Undergraduate)</td>
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<td>Fall 2016</td>
<td>ESP 734</td>
<td>Vocational and Career Education for Persons with Disabilities in Transition (Graduate)</td>
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<td>Fall 2016</td>
<td>ESP 702</td>
<td>Psychological and Social Problems in ID (Graduate)</td>
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<td>Fall 2016</td>
<td>EDSP 423</td>
<td>Collaboration and Consultation in Special Education (Undergraduate)</td>
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<td>Fall 2016</td>
<td>ESP 730</td>
<td>Parent Involvement in Special and General Education (Online, Graduate)</td>
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<td>EDSP 432</td>
<td>Serving Individuals with Disabilities and Their Families (Online, Undergraduate)</td>
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<td>Summer 2016</td>
<td>ESP 755A</td>
<td>Medically Related Aspects of Disabilities (Online)</td>
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<td>EDSP 414</td>
<td>Career Education for Students with Disabilities</td>
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<tr>
<td>Spring 2016</td>
<td>ESP 718</td>
<td>Assessment of Persons with ID (Graduate, Modular)</td>
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<td>EDSP 466</td>
<td>Group Teaching Methods for Students with Disabilities (Hybrid, Undergraduate)</td>
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<td>Serving Individuals with Disabilities and Their Families (Online, Undergraduate)</td>
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<td>Vocational and Career Education for Persons with Disabilities in Transition (Graduate)</td>
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<td>Vocational and Career Education for Persons with Disabilities in Transition (Modular)</td>
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<tr>
<td>Fall 2015</td>
<td>EDSP 432</td>
<td>Serving Individuals with Disabilities and Their Families (Online, Undergraduate)</td>
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<td>Fall 2015</td>
<td>ESP 730</td>
<td>Parent Involvement in Special and General Education (Online, Graduate)</td>
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<td>Spring 2015</td>
<td>EDSP 414</td>
<td>Career Education for Students with Disabilities (Part-Time Instructor, Graduate)</td>
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<td>Fall 2014</td>
<td>ESP 734</td>
<td>Vocational and Career Education for Persons with Disabilities in Transition (Co-teaching)</td>
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<tr>
<td>Spring 2014</td>
<td>ESP 735</td>
<td>Guest Lecture, “Arranging Consequences to Decrease Behavior”</td>
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PEER REVIEWED PUBLICATIONS: JOURNAL ARTICLES


DISSERTATION AND MANUSCRIPTS IN PREPARATION/ SUBMITTED


PRESENTATIONS

International and National Presentations: Refereed


Students with Significant Cognitive Disability. Research presented at the 2017 TASH conference in Atlanta, GA.


students with moderate or severe intellectual disabilities. Research presented at the Council for Exceptional Children National Conference, San Diego, CA.

SERVICE

Panel Member, UNLV Rebel Grad Slam Workshop (September 21, 2017) – Presented personal experience and guidance in creating and presenting a 3-minute thesis for the Rebel Grad Slam competition to interested UNLV graduate students.

Project Lead and Presenter, “Employment Solutions: Finding a Hidden Talent Source.” NV LEND project presentation (April 26, 2017) – Presented with fellow team members to transition specialists in the Clark County School District on encouraging employers to hire young adults with intellectual disabilities in competitive employment.

Co-Presenter, Panel on “Finding the Balance” in a Doctoral Program, University of Nevada Las Vegas, Department of Educational and Clinical Studies, Doctoral Summit (August 2016) – Presented with fellow doctoral students to new doctoral students on how to find the balance between doctoral studies, working, and family/personal life.

Co-Presenter, Panel on “Finding the Balance” in a Doctoral Program, University of Nevada Las Vegas, Department of Educational and Clinical Studies, Doctoral Summit (August 2015) – Presented with fellow doctoral students to new doctoral students on how to find the balance between doctoral studies, working, and family/personal life.

Co-Presenter, IEP Process Presentation, Clark County School District (Spring 2013, Fall 2013) – trained special education teachers and speech pathologists on the individualized education program (IEP) writing process and appropriate procedures.

Presenter, Special Education Staff Development, Cheyenne High School (November 4, 2013) – trained special education teachers on writing and following behavior plans.

Presenter, Paraprofessional Staff Development, Clark County School District (February, 2011) – Presentation on working with students with significant disabilities and following their individualized education programs and behavior plans and using token boards and positive reinforcement to manage behaviors in the classroom.

Professional

2016-2017 Treasurer for the Student Council for Exceptional Children, UNLV Chapter
2015-2016 Secretary for the Student Council for Exceptional Children, UNLV Chapter
2015 White paper and literature review regarding evidence-based mentoring programs for Cheyenne High School Principal
2014-Present Reviewer, Intervention in School and Clinic

System
2016-2017 NV LEND Trainee (2016-2017), Nevada Center for Excellence in Disabilities. Awarded one-year trainee position, which includes community service project development and leadership training regarding individuals with neurological disabilities and their families.


2015-2016 Peer Tutoring Planning Team, Cheyenne High School
2012-2014 FLEX Team Budget Committee, Cheyenne High School
2012-2014 Special Education Department Chair, Cheyenne High School
2012-2014 Master Schedule Committee, Cheyenne High School
2012-2014 Teacher Mentor, Clark County School District, Cheyenne High School

Community

2016-present Junior Girl Scout Troop Co-Leader, Las Vegas, NV
2011-2013 Board Member, Hill and Dale Child Development Center, Las Vegas, NV

PROFESSIONAL AFFILIATIONS

Division of Career Development and Transition, Council for Exceptional Children (2016-2018)
TASH (2014-2018)